DECEMBER, 1943

20,100 COPIES

TOOL & DIE JOURNAL

TOOLING AND PRODUCTION

TODAY . . . OUR CATALOG IS OUR STOCK LIST

761 STOCK ITEMS

ALL OF WHICH CAN BE DELIVERED WITHIN

48 HOURS

End mills that you need immediately are in stock—ready for shipment to you from the Putnam Tool plant or from the headquarters of a number of the Putnam sales representatives. In addition, complete stocks are now built up on end mill holders, continuous pilot counterbores and spiral fluted chucking reamers.

The items available include not only all popular sizes and types but many which, from any other source, would be considered special tools. To facilitate your production schedules . . . to get the maximum in tool economy . . . it's to your advantage to think of Putnam tools *first!*

ARMY E NAVY

PUTNAM TOOL COMPANY

2985 CHARLEVOIX AVE. • DETROIT 7, MICH.

SPEED UP THE JOB

Conserve LABOR AND MATERIAL

Use FCC Air Hardening Tool Steel Cast-to-Shape for blanking, forming, drawing, swaging and embossing dies; also for bushings, cams, shears, rolls and similar tooling.

These Cast-to-Shape steels deliver the job to you already half done. With only ⅛" to be machined off, even on the most intricate shapes, your dies can be put into production more quickly and at greater saving.

Cast-to-Shape tool steels are produced in a variety of analyses offering unusual resistance to wear and abrasion. They are manufactured in electric furnaces under precision laboratory control.

Back the Attack with War Bonds

Prompt delivery
to your specifications

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For Booklet L

QUALITY FCC SERVICE

THE FORGING and CASTING CORPORATION

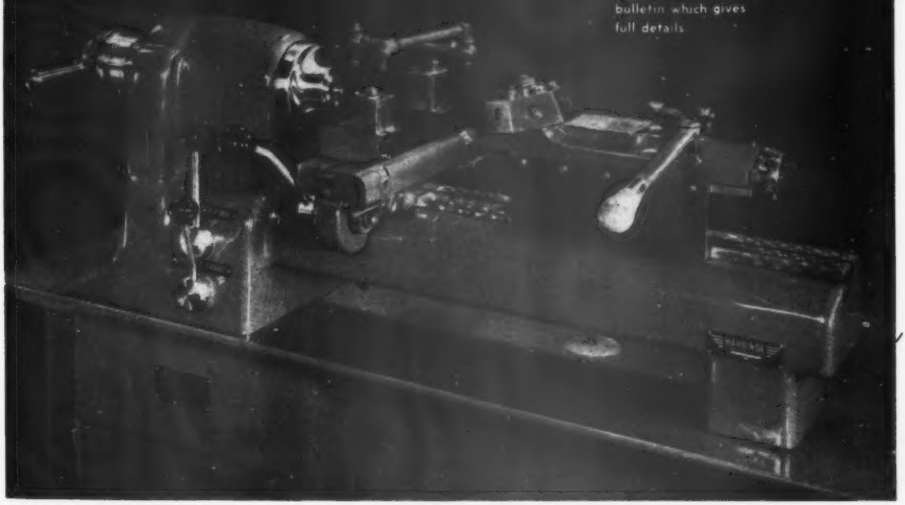
FERNDALE (DETROIT) MICHIGAN

HARDINGE
ELMIRA, N.Y.

Your operator in front of this HARDINGE High Speed Precision Second Operation Machine will result in: lower costs
better finish
greater accuracy
less fatigue

CAPACITY
1/16" to 1" with collets
1" to 6" with step chucks
1" to 5" with jaw chucks
Spindle Speeds: 230 to 4000 R.P.M.

Ask for this 8 page bulletin which gives full details



Bunell

TOOL AND DIE DESIGN AND CONSTRUCTION
PRECISION PARTS DESIGN AND MANUFACTURE

FROM lay-out to inspection, our contract shop facilities are modern and adequate.

Ingenious designers, qualified engineers, skilled craftsmen, capable machine operators, careful inspectors — all directed by an experienced supervisory staff — assure war contractors and post-war manufacturers fine tooling and excellent parts and products.

Our capacity is large and we have portions of it available from time to time.

23 years of service

Chamber of Commerce award as the best small industrial plant completed in 1941-42.

THE BUNELL MACHINE & TOOL COMPANY

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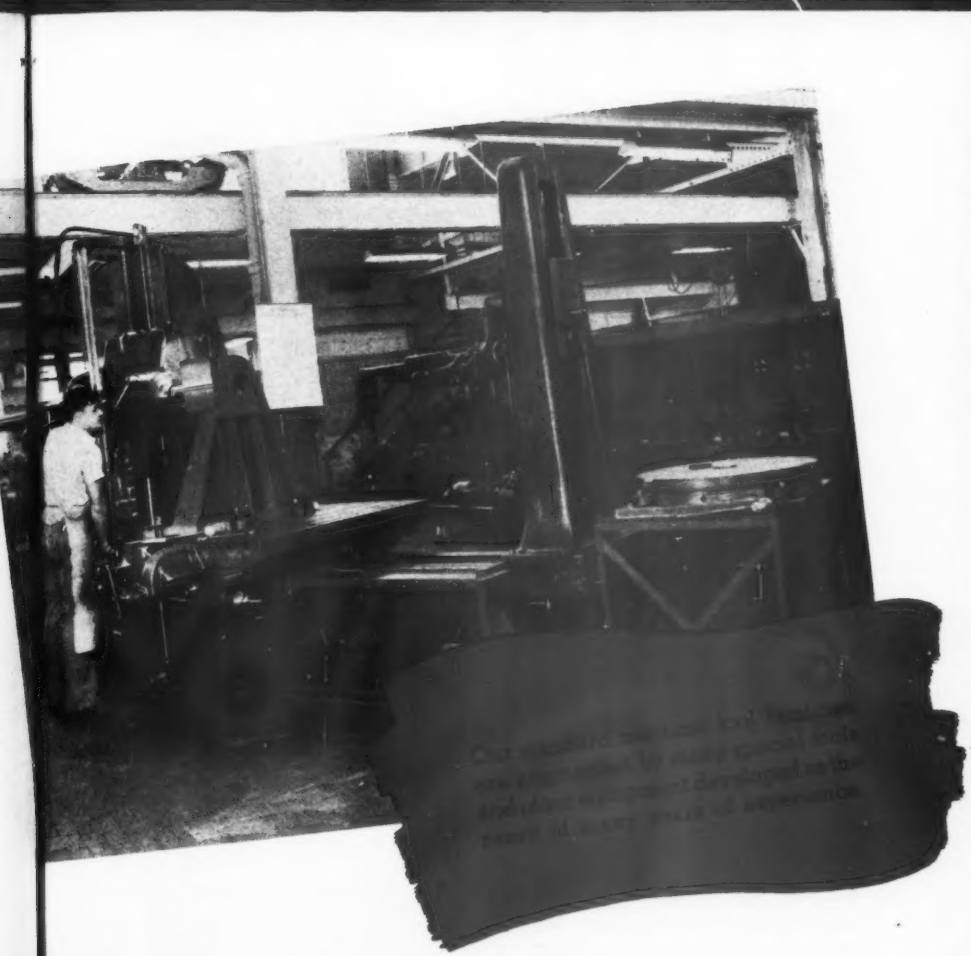
HAS WHAT IT TAKES TO
DO YOUR JOB RIGHT
. . . at the right price



DESIGNERS AND MANUFACTURERS OF

Tools • Special Machinery • Dies • Jigs • Gauges • Fixtures

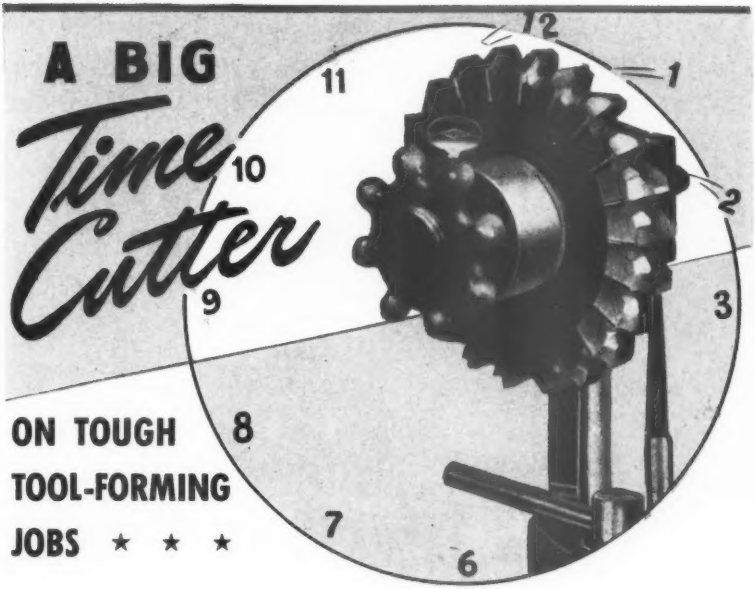
PRECISION PRODUCTION OF PARTS AND ASSEMBLIES

America's "production miracle" has required new, inspired tools as well as inspired workers. In this inspired production, MEYERS "Dia-Brasive" Diamond Tools—and our many years of specialized experience—are helping solve unusual grinding problems. We offer standard and special designs of Multiple and Single Point Diamond Dressers for regular and unusual applications, including economy specials for cylindrical grinders and carboloy wheels. There's a MEYERS representative close to you—wire, phone or write for him to call. Send for literature just off the press.

W. F. MEYERS COMPANY · *Established 1888*

1016 FOURTEENTH STREET, BEDFORD, INDIANA

A BIG *Time Cutter* ON TOUGH TOOL-FORMING JOBS ★ ★ ★



The New MEYERS *Radiform* WHEEL and TOOL FORMER

MOUNTS AND FORMS TOOLS
Without First Forming the Wheel

● This new MEYERS tool not only cuts many hours from difficult wheel and tool forming jobs—but at the same time saves critical tool steel stock. Tools are mounted and formed directly against a standard wheel without first forming the wheel. Demonstration models for trial use and complete tools for examination are available from the MEYERS representative in your territory. Wire, call or write for immediate interview.

W. F. MEYERS COMPANY
Established 1888
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GAGES — DIES — SPECIAL PARTS

Gun and Instrument Parts, in production quantities, and to extremely close tolerances have long been made by us. These are entrusted to us because we have proved that we possess the capacity — machines and highly trained, skilled personnel necessary for this important work.

Designing and Building Gages, Dies and Fixtures is our job, and we enjoy the confidence of many of the foremost users of such tools. It is our organization of skilled mechanics that earns that confidence.

You may have a problem involving the quantity production of Special Parts, or Tools. If so, we can be of service to you.

FEDERAL TOOL CORPORATION

400 North Leavitt Street — CHICAGO, ILLINOIS

A TIME SAVER

. . in SETTING and KEEPING your machines LEVEL

Time and manpower are important today —save on both by using Empco Jacks to set and keep your machines level. Periodic re-leveling is essential for accurate work tolerance and that is why it is important for you to use Empco Jacks because they can be re-leveled easily and quickly. . . . The reason for this simplicity of operation is due to Empco construction of only 3 parts. . . . Simply apply a wrench to "hex" screw head, turn right or left until your level indicator reads "zero". Wire or write today for prices.

Available in 3 sizes.

IMMEDIATE DELIVERY

all deliveries are made from stock.

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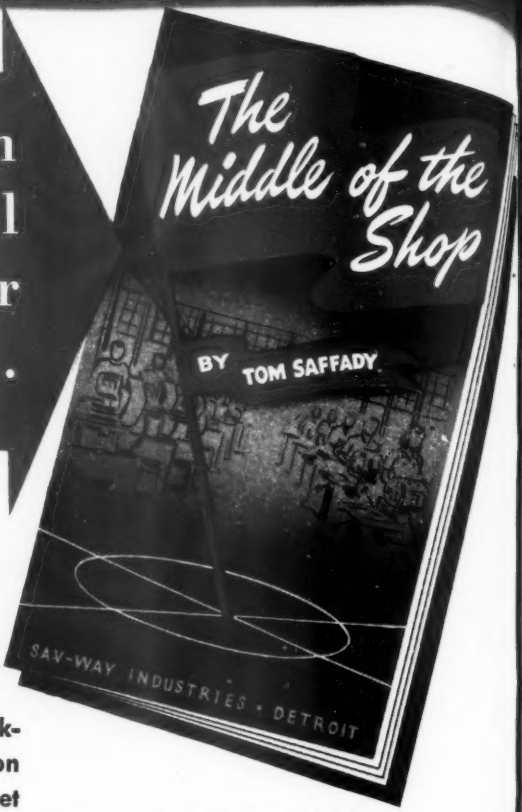
THE ENTERPRISE MACHINE PARTS CORPORATION

2735 JEROME AVE. DETROIT, MICH.

for production men who still like to get their hands dirty . . .



READING TIME—
10 MINUTES

THIS thought-stirring little booklet is addressed to production executives who still like to get their hands dirty; who get a kick out of going down in the shop, taking off their coats, rolling up their sleeves and finding out first-hand what's wrong with job Number 2365! It is addressed to men who still believe that the machines which turn a piece of raw material into a finished part, are pretty important factors in the modern production scheme.

If you like new and refreshing ideas handed out straight from the shoulder, this little booklet will be well worth the ten minutes it will take you to read it.

Sav-way **INDUSTRIES**

4875 E. EIGHT MILE
DETROIT 13, MICHIGAN

SAV-WAY INDUSTRIES, Box 117, Harper Station, Detroit 13, Michigan
Please send me a copy of "The Middle of the Shop".

Name_____

Firm_____ Position_____

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Send the Coupon for Your Free Copy!

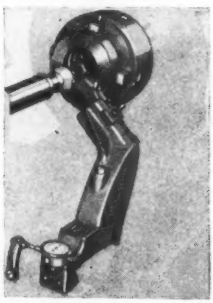
NEW
INTERNAL
AND
SURFACE

GRINDER

Micrometer screw adjustment on the automatic power cross-feed. Both rack and pinion and screw feed available for longitudinal travel. Mechanical stops prevent spoilage. Chucks mounted ***fast*** by a single draw bar through hollow work spindle. 80 and 130 R.P.M. quick-change work speeds; 6,000 and 12,000 R.P.M. spindle speeds. 2 H.P. grinding head motor; ½ H.P. workhead motor—all self-contained.

TURNS AND GRINDS

- ★ **Internal • External • Surface • Taper Jobs**
- ★ **Built-in Coolant System**
- ★ **Retractable Work Head Allows Additional Clearance for Larger Work**
- ★ **Turns and Grinds Successive Pieces Without Changing Set-Up**



EXCLUSIVE AUTO-SIZER

Saves man-hours and machine-hours on single operation jobs. Arm with dial indicator sizes directly from work diameter. Exactly duplicates successive pieces.

PRICE
$1995
GOOD DELIVERY!

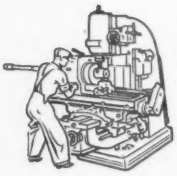
WRITE FOR CIRCULAR

LEMPCO

5713 DUNHAM RD. • BEDFORD, OHIO

CORRECT CUTTER SPEED

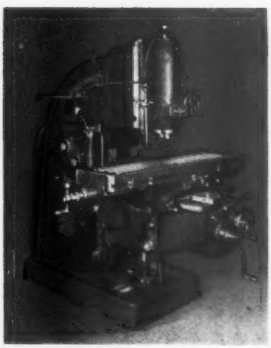
Selected without Walking Around



THIS type of job, like many others in the average shop, requires a change in spindle speed (cutter speed) to obtain any semblance of production, finish and cutter life. The part requires a milled relief around the main diameter at the large end. A 1-13/64" diameter end mill, running at 188 r.p.m., mills the principal portion of the relief. This leaves too large a radius at the end of the cut, so it is then removed with a .407" diameter cutter running at 550 r.p.m.

With CINCINNATI Quick Change Collets, the cutters are changed in a few seconds, and with the exclusive Dial Type feature of power speed and feed change from the front operating position, the speeds are changed as desired in a few clicks of the speed dial . . . without taking a step.

This one Dial Type feature alone is worthy of your most serious consideration when selecting new milling machine equipment. There are a host of other Dial Type features, too, some of which are tabulated in Sweet's Catalog File for Mechanical Industries. All of them, along with complete engineering data, will be found in catalog M-970-2, a copy of which may be had for the asking.



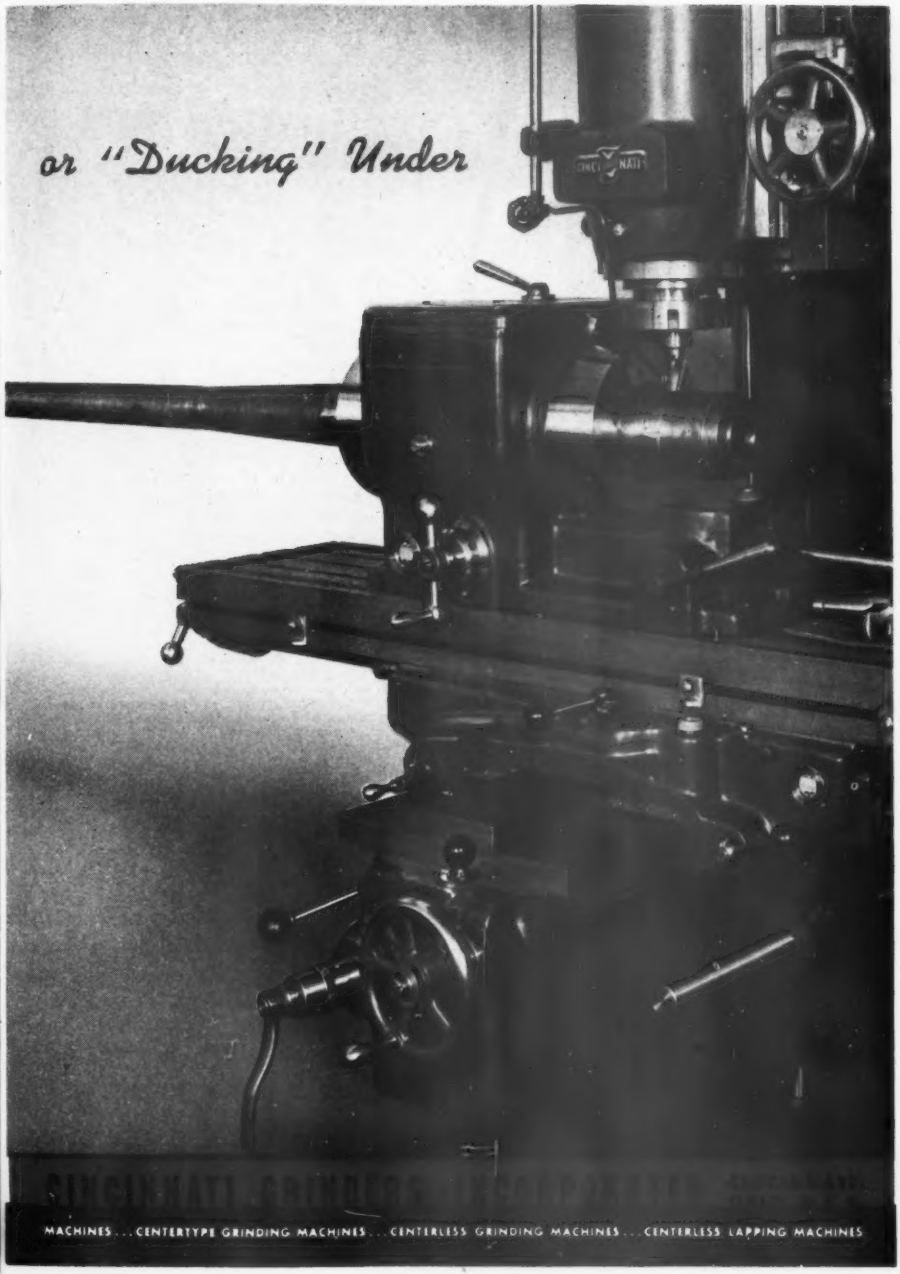
Left: CINCINNATI Vertical Dial Type Milling Machine. The Dial Types are made in plain, universal, and vertical styles, Nos. 2, 3, and 4 sizes, medium speed and high speed ranges. Complete engineering specifications may be obtained by writing for catalog M-970-2.

CINCINNATI

Right: A CINCINNATI No. 3 Vertical Dial Type Milling Machine, equipped with a special power feed rotary milling work head. The operation consists of milling a circular recess on the part. This job was tooled up by CINCINNATI Service Engineers, who will be glad to draw upon their experience in solving your unusual milling problems.

THE CINCINNATI MILLING MACHINE CO.

TOOL ROOM AND MANUFACTURING MILLING MACHINES . . . SURFACE BROACHING MACHINES . . . CUTTER SHARPENING


or "Ducking" Under
MACHINES . . . CENTERTYPE GRINDING MACHINES . . . CENTERLESS GRINDING MACHINES . . . CENTERLESS LAPPING MACHINES

...minded production men

See that kid in uniform? It's his first morning home. He's finished with his job of fighting a war. Now there is peace. But can it be peace if this kid — yours, perhaps — and millions more like him, face a "no help wanted" future? American business has the answer. It's sales. Sales make jobs. Production must promote sales . . . by making it better, faster, in greater quantity for less money, for more people. How about your productive "sales promotion" equipment? Your lathes, for instance? Will they turn to the tempo of *lowest cost post war production? A "maybe"* answer won't do. The boys coming back have a heritage coming due. It is largely up to "heir" minded production men to see that they get it . . . the opportunity to earn an honest living by honest work in support of the *real* American standard of life.

MEMO: *U. S. Department of Commerce predicts that if the war lasts through 1944, Americans will have accumulated savings amounting to $100,000,000,000. Be prepared for mass marketing. From now on business must reckon with huge masses of buyers.*

THE R.K. LeBLOND MACHINE TOOL CO., CINCINNATI, 8

time to retool
Turn to LeBlond for Turning Equipment
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

ARMY-NAVY E — LEBLOND — 1

Check-Clip-Mail

FOR ILLUSTRATED SPECIFICATIONS:

- ☐ HEAVY DUTY GEARED HEAD ENGINE LATHES
- ☐ TOOL ROOM LATHES
- ☐ AUTOMATIC LATHES
- ☐ HEAVY DUTY GEARED HEAD GAP LATHES
- ☐ SUPER REGAL GEARED HEAD LATHES
- ☐ RAPID PRODUCTION LATHES
- ☐ AUTOMATIC CRANKSHAFT LATHES
- ☐ No. 2 CUTTER GRINDER

YOUR NAME _____ TITLE _____
YOUR FIRM _____ ADDRESS _____

LEBLOND BRANCH OFFICES

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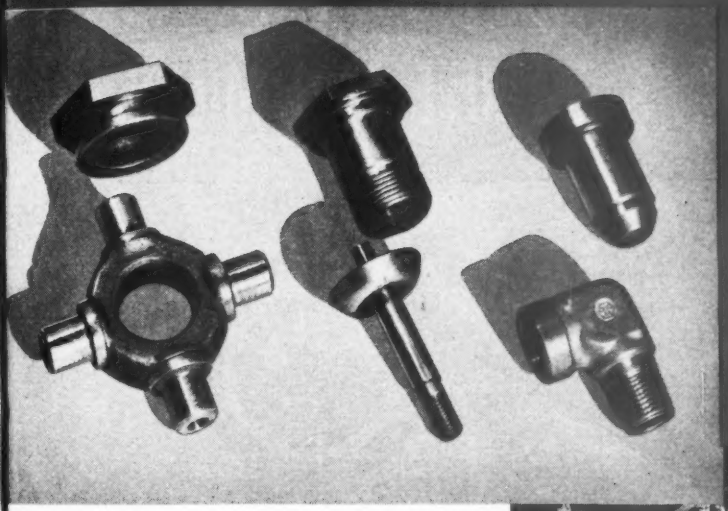
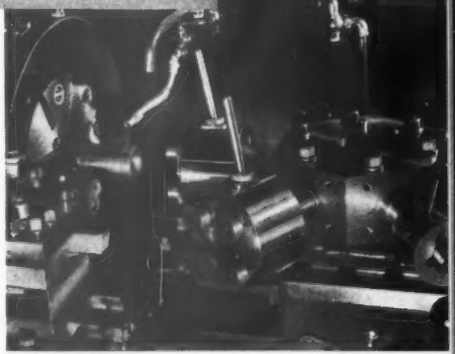
CAnal 6-5281

Your Bonds Buy Bombs
Buy a *Today*

How to SPEED UP
END FORMING AND END TURNING



and maintain uniform accuracy

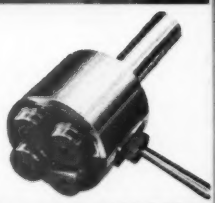


FOUR cutting edges, in one automatic head, do *three* times the work of any single point tool.

For diametric adjustments, you don't fuss with separate cutters for different diameters —one adjustment of circular mills brings them all to size—right on the machine.

Namco self-opening die heads with multiple circular hollow milling cutters turn out thousands, or hundreds of thousands, of identical pieces with positively NO variation in dimensions. Namco heads are double-duty tools; circular ground thread chasers are interchangeable with hollow milling cutters.

Here is the modern way to cut costs without loss of precision. Catalog D-42 gives complete information.



Hollow milling, threading and tapping with Namco die heads and collapsible taps.

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

ACME GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES

Announcing THE MOST IMPORTANT END MILL DEVELOPMENT IN 20 YEARS!

MELIN *Long Life High Speed* 3-FLUTE END MILLS

AT LAST! An End Mill that ***combines*** in a ***single tool*** all the advantages of two and four flute mills with none of the disadvantages of either!

★ AFTER YEARS of research, Melin Mills introduces the significant new MELIN **3-FLUTE** END MILL. It combines the fast stock removing qualities of the two-flute mill with the smooth finishing qualities of the four-flute mill.

THIS REMARKABLE **3-FLUTE** construction provides perfect balance and permits roughing and keyway milling to be done within closer limits . . . and with a smoother finish. All decarburized metal is ground off the cutting edge of the tool. Double backoff insures a stronger cutting edge and the **3-FLUTE** construction assures extra sturdiness, reducing breakage to a minimum.

WRITE TODAY FOR COMPLETE DETAILS AND NEW CATALOG

MELIN MILLS

DETROIT 2228 Bellevue Ave.
GRAND RAPIDS 1331 Phillips, S.W.

MELIN MILLS
2228 Bellevue Ave., Detroit 7, Mich.
Without obligation, please send me
☐ Complete details on MELIN 3-FLUTE END MILLS.
☐ New Catalog No. 6 and literature.

NAME_____ TITLE_____
COMPANY_____
CITY_____ STATE_____

A Better Way to Inspect—
HOLE DIAMETER

because—

of a better way to transfer motion around a corner.

With this Gage you can "explore" a hole for roundness, taper, hollow and high spots, as well as accuracy of diameter, faster and with greater sureness.

Its accuracy and positiveness are exceptional because of its unusual method of carrying the dimensional variations to the Dial Indicator. The motion is carried direct *without* internal friction or lost motion in the Indicator.

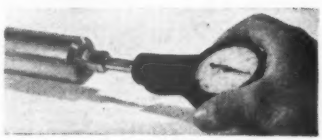
It has none of the limitations of conventional plug gages. Customers who have used various kinds of hole gages report a decided preference for this gage. Tell your requirements to—

FEDERAL PRODUCTS CORPORATION
1144 EDDY ST., PROVIDENCE 1, R. I.

CHICAGO • CLEVELAND • DETROIT • DALLAS • HARTFORD • HOUSTON • INDIANAPOLIS • LOS ANGELES MEMPHIS • MILWAUKEE • MINNEAPOLIS • MONTREAL NEW YORK • PHILADELPHIA • PITTSBURGH ROCHESTER • SAN FRANCISCO • ST. LOUIS • TORONTO WINDSOR

The motion of the sensitive contact is carried directly without error to the Dial Indicator.

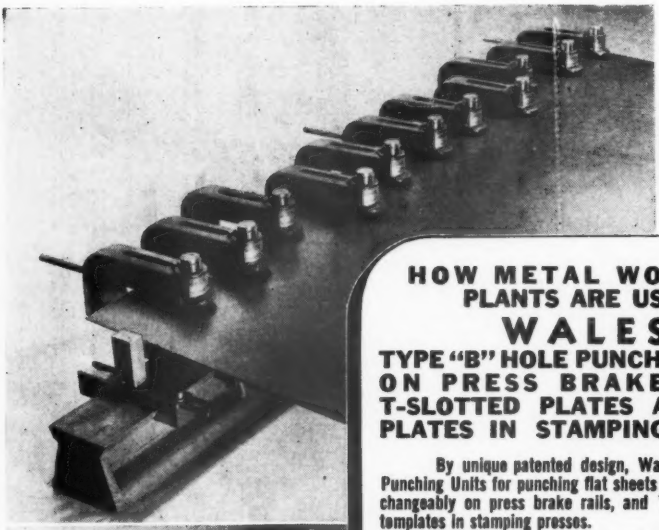
Special adaptations are always possible.



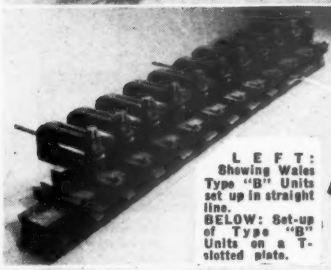
Holes from ½" up in diameter and of various lengths can be gaged. You don't guess, you *see* the actual variations.

★ FEDERAL ★ ★

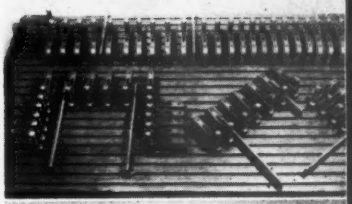
PRECISION MEASURING INSTRUMENTS

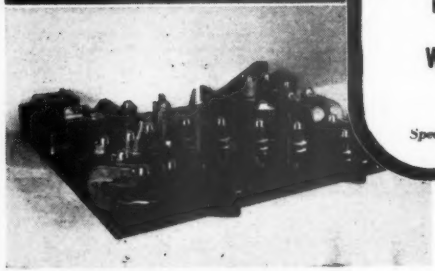


Showing staggered pattern set-up for punching holes in sheets on press brakes. This is made possible by Wales Adjustable Adapters.



LEFT: Showing Wales Type "B" Units set up in straight line.
BELOW: Set-up of Type "B" Units on a T-slotted plate.





Template set-up of Type "B" Hole Punching Units for stamping presses.

HOW METAL WORKING PLANTS ARE USING

WALES

TYPE "B" HOLE PUNCHING UNITS ON PRESS BRAKE RAILS, T-SLOTTED PLATES AND TEMPLATES IN STAMPING PRESSES

By unique patented design, Wales Type "B" Hole Punching Units for punching flat sheets can be used interchangeably on press brake rails, and T-slotted plates or templates in stamping presses.

Set-ups on T-slotted plates and templates are quickly made by simply bolting the units in exact position according to master pattern. Each unit is independent and self-contained with punch and die held in constant alignment by holder. This makes it possible to set the units in any location on plates. Units are easily moved or replaced in set-ups so they can be used and reused to eliminate costly "dead storage."

For press brake set-ups these units are clamped on Wales adapters which are clamped to Wales press brake rail. The adapters are designed for front to back adjustment to provide staggered as well as straight line hole patterns.

Other time-saving, money-saving features built into Wales Type "B" Hole Punching Units:—

Nothing is attached to press ram...punch and die holder is a self-contained unit...punch and die are always in perfect alignment eliminating the usual time-consuming adjustments required to line up punches and dies of conventional set-ups...interchangeable punches and dies to punch various sizes and shapes with same holders...die setting time and press "down time" are cut from hours to minutes.

"There's Always Something New in the Wales Line."
Keep posted by writing for Catalog "B."

WALES-STRIPPIT CORPORATION
GEORGE F. WALES, President
NORTH TONAWANDA, N. Y.
Specialists in Punching and Notching Equipment

BOTTLENECKS
DAMN THE TORPEDOES
FULL SPEED AHEAD!

Making only Mounted Wheels and small Grinding Wheels—maintaining highest quality in spite of large quantities and rush orders—shipping them promptly—this is our job, our battlefield.

With full WPB approval, we stopped making all large size grinding wheels and fixed our sights on wheels *3" in diameter and under.*

We worked all around the clock, 24 hours a day, and in a short time were able to fill orders on time—And, our central location cuts time in transit. Today, there is no waiting. With the Army-Navy E at our masthead, we are going full speed ahead.

Half a century of specialization has established our reputation as the Small Wheel People of the Abrasive Industry. You can bank on us.

TEST WHEEL FREE— To get acquainted with Chicago Wheels, let us send one postpaid. Tell us size wheel and material you wish to grind.

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AMERICA'S HEADQUARTERS FOR MOUNTED WHEELS SMALL GRINDING WHEELS

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TD-12

Send Catalog. Interested in:
☐ Mounted Wheels ☐ Grinding Wheels
☐ Send Test Wheel. Size.....

Name .....
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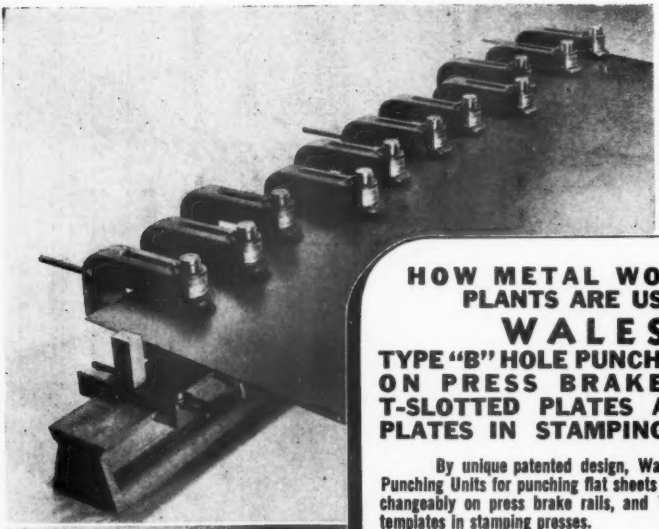

Showing staggered pattern set-up for punching holes in sheets on press brakes. This is made possible by Wales Adjustable Adapters.

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WALES

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For press brake set-ups these units are clamped on Wales adapters which are clamped to Wales press brake rail. The adapters are designed for front to back adjustment to provide staggered as well as straight line hole patterns.

Other time-saving, money-saving features built into Wales Type "B" Hole Punching Units:—

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Keep posted by writing for Catalog "B."

WALES-STRIPPIT CORPORATION
GEORGE F. WALES, President
NORTH TONAWANDA, N. Y.
Specialists in Punching and Notching Equipment

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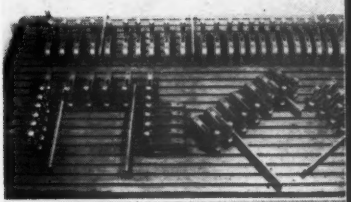
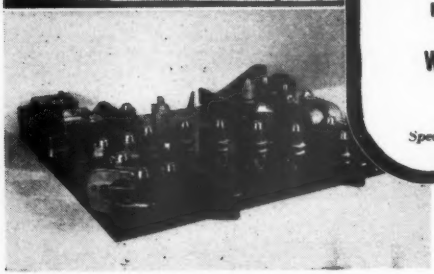
BELOW: Set-up of Type "B" Units on a T-slotted plate.





Template set-up of Type "B" Hole Punching Units for stamping presses.

BOTTLENECKS
DAMN THE TORPEDOES
FULL SPEED AHEAD!

Making only Mounted Wheels and small Grinding Wheels—maintaining highest quality in spite of large quantities and rush orders—shipping them promptly—this is our job, our battlefield.

With full WPB approval, we stopped making all large size grinding wheels and fixed our sights on wheels *3" in diameter and under.*

We worked all around the clock, 24 hours a day, and in a short time were able to fill orders on time—And, our central location cuts time in transit. Today, there is no waiting. With the Army-Navy E at our masthead, we are going full speed ahead.

Half a century of specialization has established our reputation as the Small Wheel People of the Abrasive Industry. You can bank on us.

TEST WHEEL FREE— To get acquainted with Chicago Wheels, let us send one postpaid. Tell us size wheel and material you wish to grind.

ARMY E NAVY

Write for illustrated catalog

AMERICA'S HEADQUARTERS FOR MOUNTED WHEELS SMALL GRINDING WHEELS

CHICAGO WHEEL & MFG. CO.
1101 West Monroe Street, Dept. TD, Chicago 7, Illinois

TD-12

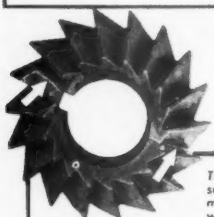
Send Catalog. Interested in:
☐ Mounted Wheels ☐ Grinding Wheels
☐ Send Test Wheel. Size.....
Name .....
Address .....

This high speed steel metal saw was put back on the job in quick time with a few cents worth of EASY-FLO. A new saw would have cost $11.00.

to mend broken tools with

EASY-FLO

SILVER BRAZING ALLOY



The four broken surfaces of this milling cutter were first tinned with EASY-FLO. The two pieces were then put together and torch-heated uniformly until the alloy flowed. The entire job took only 20 minutes. A new cutter would have cost $10.00.

This helical milling cutter was EASY-FLO tinned and brazed, ready to go back to work, in less than an hour including all operations. The exceptional strength of the EASY-FLO joint makes it as serviceable as a new cutter.

With a few cents worth of EASY-FLO, anyone handy with a torch can quickly put broken tools back into good-as-new working condition. This has been demonstrated in scores of shops where cutters, broaches, punches, dies, taps, drills and many other valuable tools have been restored to duty the easy EASY-FLO way in a matter of minutes and at a small fraction of what it would have cost to replace the tools. The examples illustrated are typical.

If you are in any way responsible for production you will want to know how low-temperature EASY-FLO makes possible and practical this fast, inexpensive method of making tool repairs. BULLETIN 12-A will tell you. Write for your copy now.

ARMY E NAVY

FOUNDED 1867

HANDY & HARMAN

82 FULTON ST., NEW YORK 7, N. Y.

Bridgeport, Conn. • Chicago, Ill. • Los Angeles, Cal. • Providence, R. I. • Toronto, Canada

Agents in Principal Cities

With flexible shaft, with stationary set-up, or by hand SEVERANCE CUTTERS do the job cleaner, faster, easier

Because of their hardness, design and keen cutting edges, Severance Midget Milling Cutters speed up finishing time, easily do the job two to three times faster than any other type of rotary tool. They take deep, sharp bites and after the teeth are worn, can be successfully reground scores of times.

Left: A Severance Midget Milling Cutter being used in a stationary set-up, which many manufacturers of small parts have found to be a great time saver. The part is held in the hand, the tool is held in a chuck on any type of bench lathe, polishing unit or flexible shaft mounted in a vise.

Right: One of the Severance Hand Deburring tools. With a twist of the wrist this Cutter easily bites off the burr or sharp edge left by a drill or punch. Available in a wide range of sizes with radius, ball nose or angle. Write for complete facts on how Severance Midget Milling Cutters can help you speed up your cleaning and finishing operations.

Severance complete line of "Carbide" Midget Milling Cutters are now available.

Severance

Severance Tool Industries Inc., Saginaw, Michigan. Plants in Long Island City, New York; Detroit, Michigan; Fort Wayne, Indiana; Chicago, Illinois; Los Angeles, California.

For the Extremes

STYLE 11

STYLE 29SR

and All Between

KENNAMETAL

HERE illustrated are two machining tools—one large, the other small, but each is a *great* tool—Kennametal. The cutting edge for the large one is ground on a tip of carbide brazed to the steel shank, that for the small one is ground on a solid round piece of carbide. Each is just as keen as the other for its specific purpose, each equally distinguished for superior performance on jobs within its scope of application. The large tool is for rough turning, the small tool for precision boring.

Here are two extremes in size and purpose, but in between is an array of Kennametal tools suitable for a wide variety of uses—thirty or more different styles, many sizes in each, five available grades of carbide in varying degrees of hardness. Every Kennametal tool, when fitted to its specific job, and correctly used, makes a distinctive contribution to the metal working industry. Maximum machining production, superior finish, accuracy to close tolerances, enduring service—these are outstanding characteristics.

Our new Catalog 43C gives information for selecting, ordering, and maintaining the wide variety of Kennametal tools. Do you have a copy? If so, are you making full use of it?

KENNAMETAL Inc.
500 Lloyd Ave., Latrobe, Pa.
Trade Mark Reg. U. S. Pat. Off.

KENNAMETAL THE All American CARBIDE

NOW... Lower Costs for
L&I GROUND FLUTE REAMER
Performance

This means that you can get the keen-edged performance and longer life of these superior small reamers for the same first cost as ordinary milled flute reamers.

The useful-life cost of L & I Reamers is far less than other reamers — because they are carefully lapped after the flutes have been ground.

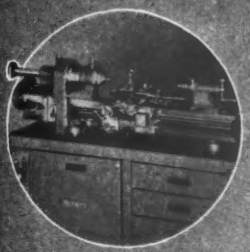
The smoother surface finish and extreme accuracy are *plus* values — made possible because L & I Ground Flute Reamers are heat treated in bar form, and *ground in the solid.*

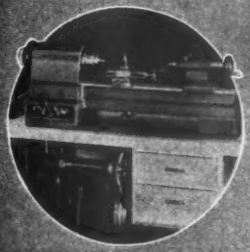
Straight Flute Reamers in Diameters Up to ¼". Trial Orders Suggested.

LAVALLEE & IDE, INC.
GROUND FLUTE REAMERS
CHICOPEE, MASS.

L&I

RIVETT





ARMY E NAVY

TOOL-ROOM LATHES

RIVETT 608 back-geared, screw cutting lathe is recognized the world over for its ability to produce fine work within guaranteed precision limits. In manufacturing, tool-making and experimental work, it will handle a great variety of parts in minimum time. Finely made attachments for milling, spiral cutting, slotting, relieving, taper turning, ball turning, grinding, forming and multiple operations are available. Swing is 8½" dia.; center distance is 18¼"; collet capacity is 1" max.

PLAIN BENCH LATHES

RIVETT plain precision bench lathes have vastly increased the earning power of such machines. An engineered unit, a Rivett lathe is quick to set-up, has wide speed range, power and vibrationless performance and is capable of many jobs often produced on heavy, costly machines. Two sizes are furnished: Series 715 has 7" dia. swing, 15" center distance and ¾" max. collet capacity; Series 918 has 9" dia. swing, 18" center distance and 1" max. collet capacity.

HAND SCREW MACHINES

RIVETT 918 hand screw machine incorporates precision, balanced design and operating features to make it an efficient producer on small duplicate parts. Bar stock passed through spindle may be held in push-out collet, while work individually chucked may be held in draw-in collet, step chuck or jaw chuck. In combination with six turret operations, double tool cross slide can be furnished for straight or taper turning, forming or cutting-off. Swing is 9" dia. and collet capacity is 1" max.

INTERNAL GRINDERS

RIVETT internal grinders are primarily designed for tool room work, however, are used extensively in precision manufacturing. Available internal and external spindles in combination with many adjustments make possible a great variety of grinding operations. Two sizes are furnished: Series 104 has internal and external grinding capacity up to 3" dia. with power table travel up to 4"; Series 112 has internal and external grinding capacity up to 8" dia. with power table travel up to 8"

Write for General Bulletin 500

RIVETT LATHE & GRINDER INC.

BRIGHTON, BOSTON, MASS., U.S.A.

TOOLS for TODAY
and TOMORROW
The modern cutting tools that are setting new production records today, and the gages that control this production, insure new and better products for all industry in the years to come.
When these gages and tools carry the PM Diamond emblem, you may be doubly sure of their quality and accuracy.
Have you the latest PM Catalog on your desk?
PM CO
The PIPE MACHINERY COMPANY Cleveland, O.

Announcing

PLAST-O-LOCK

A *New* COLLET-TYPE GAUGE *that multiplies the life of STANDARD PLUG GAUGES*

This new development, PLAST-O-LOCK (pat. applied for), by Turner brings to industry a plastic collet-type gauge that greatly increases the life of standard plug gauges. This PLAST-O-LOCK gauge features a collet of plastic, slotted and tapered to fit into the tapered end of a standard plastic handle. With PLAST-O-LOCK, the holding area of plastic against the gauge's surface does not scratch or burr, thereby allowing use of most of the gauge's length. For example, as the "go" and "no go" ends are worn beyond allowed tolerances they are simply cut off, thus leaving an unused end ready for gauging. To illustrate further, if a boring no deeper than ⅛" is being checked, as many as 8 fresh gauging sections may be obtained from one standard length "go" gauge as furnished with Turner's PLAST-O-LOCK. This obviously eliminates the necessity of salvaging used gauges.

• • •

Turner Gauging members for use with Turner's PLAST-O-LOCK collet-type gauge can be obtained in steel, chrome, tungsten carbide or Nor-Bide. When sending your order specify the type you require.

For a complete description of the PLAST-O-LOCK Gauge, wire or write us on your company stationery.

★ *Features* ★

1. Multiplies the life of the plug gauge.
2. Collet will not mar a lapped or polished surface.
3. Used with plastic handle the gauge has a more sensitive feel in the hands of an inspector.
4. Is easy to make length adjustment because slot is provided for end wrench.
5. PLAST-O-LOCK size range from .050 to .690.

TURNER BROTHERS

TURNER GAUGE GRINDING COMPANY

2624 HILTON ROAD • • • • FERNDALE, MICH.

These case histories show how . . .

YOU CAN CONSERVE ESSENTIAL MATERIALS ★ EXTEND TOOL LIFE ★ SPEED PRODUCTION

with *Advance* HARD CHROME PLATING

1 SALVAGING UNDERCUT PISTONS

During inspection, several hundred airplane pistons were found to have been cut undersize. After masking of the correctly machined areas, .003" of hard chrome was applied to the undercut diameters. The pistons were then ground to size and the entire lot saved from the scrap pile.

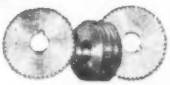
The cost of plating was negligible compared to the savings effected in materials and man hours.

2 LONGER LIFE FOR SHELL PUNCHES

Punching 20 and 37 millimeter machine gun shells from steel is a severe operation. Manufacturers have found a plating of hard chrome on these punches extends their working life.

Punches which are undersize have been salvaged and put back into service after a plating of hard chrome, usually .010" thick, has been ground to the proper size.

3 GREATER PRODUCTION SPEEDS



Tests recently made show an increase in production of better than 100% when a .0001" plating of chrome was applied to the sides of the slotting saws.

Reports show that this production increase was obtained when these cutters were used in cutting piston rings from extremely hard phosphor-bronze.

Material savings were made in grinding time.

SPECIFY *Advance* HARD CHROME PLATING

Our engineers will be glad to study your shop problems and suggest plating operations that will cut tool costs, increase production, keep rejects at a minimum and conserve equipment.

Write, Wire, or 'Phone

Advance **HARD CHROME**

THE ADVANCE PLATING COMPANY

395 E. 131st Street • CLEVELAND 8, OHIO • Tel. GLenville 6742

APCO QUALITY PLATING

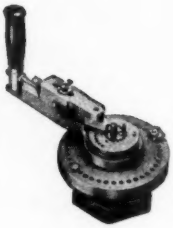
PRECISION CENTERED EYE BENDING with DI-ACRO BENDERS

A Centered EYE in 1 Operation

The DI-ACRO Bender makes perfectly centered eyes from rod or strip stock at the rate of up to 1000 an hour. Both eye and centering bend are formed with one operation. Any size eye may be formed within capacity of bender and ductile limits of material.

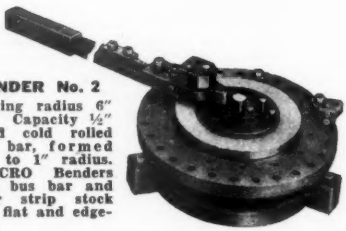
BENDER No. 1

Forming radius 2" app. Capacity 7/32" round cold rolled steel bar or equivalent. All DI-ACRO Benders have two-way action, right or left hand mounting and reversible forming nose.



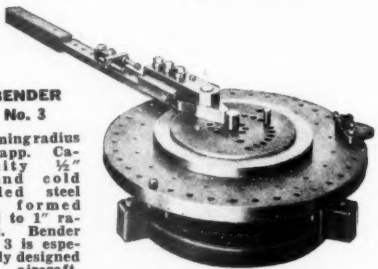
BENDER No. 2

Forming radius 6" app. Capacity ½" round cold rolled steel bar, formed cold to 1" radius. DI-ACRO Benders form bus bar and other strip stock both flat and edgewise.



BENDER No. 3

Forming radius 9" app. Capacity ½" round cold rolled steel bar, formed cold to 1" radius. Bender No. 3 is especially designed for aircraft, marine and other large radius bending.



DI-ACRO precision bending is accurate to .001" for duplicated parts. DI-ACRO Benders bend angle, channel, rod, tubing, wire, moulding, strip stock, etc. Machines are easily adjustable for simple, compound and reverse bends of varying radii.

Send for Catalog "DIE-LESS DUPLICATING"

showing many kinds of "DIE-LESS DUPLICATING" produced with DI-ACRO Benders, Brakes and Shears.

DI-ACRO PRECISION MACHINES DIE-LESS DUPLICATING

O'NEIL-IRWIN MFG. CO.

315 8th Ave. S.
Minneapolis 15, Minn.

Die Sets don't sing IN G.I. QUARTETTES

American Servicemen—soldiers, sailors, and marines, will sing—nothing will stop them—no more than anything will stop them in their drive to victory.

Behind-the-line products that never get to the front, Danly Die Sets are stamping out and forming millions of parts for implements of war that will shorten the drive to victory for those tough, laughing, fighting men.

If you need die sets in your production, call Danly. Our facilities and services are still increasing to serve your immediate needs.

Call Danly:

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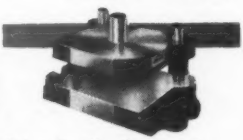
MILWAUKEE	Broadway 1644
DETROIT	Cherry 6666
CLEVELAND	Express 0300
DAYTON	Fulton 6651
ROCHESTER	Main 2554
PHILADELPHIA	Radcliff 2323
LONG ISLAND CITY	Ironsides 6-8080
DUCOMMUN METALS & SUPPLY CO. Los Angeles	Kimball 0181



DANLY MACHINE SPECIALTIES, INC.
2100 So. 52nd Avenue • Chicago 50, Cicero, Illinois

DANLY DIE SETS

Welded Steel Fabrication

HOW TO *Save Time* IN DEEP DRILLING!

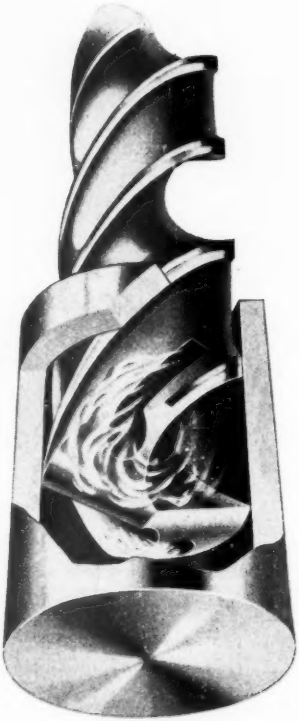
USE A DRILL THAT YOU CAN SPEED UP!

With a Super-Kool Oil Hole Drill you can drill at a much higher rate of speed than with ordinary drills, thus effecting a notable reduction in drilling time.

This is because the Super-Kool Drill provides a constant supply of oil at the cutting edge, making it possible to speed up the drilling operation without endangering the drill through overheating.

The pressure of the oil through the holes in the shank, in addition to keeping the drill cool, also serves to clear away the chips, thus eliminating the danger of scoring.

Widely used not only because of the superior work it performs but also because it has a life two to three times that of ordinary drills. Try it and see for yourself.



All sizes from 3/8" to 3 1/2" in diameter and up to 36" overall

Detroit Reamer & Tool Co.

2830 E. 7-Mile Road Detroit 12, Michigan

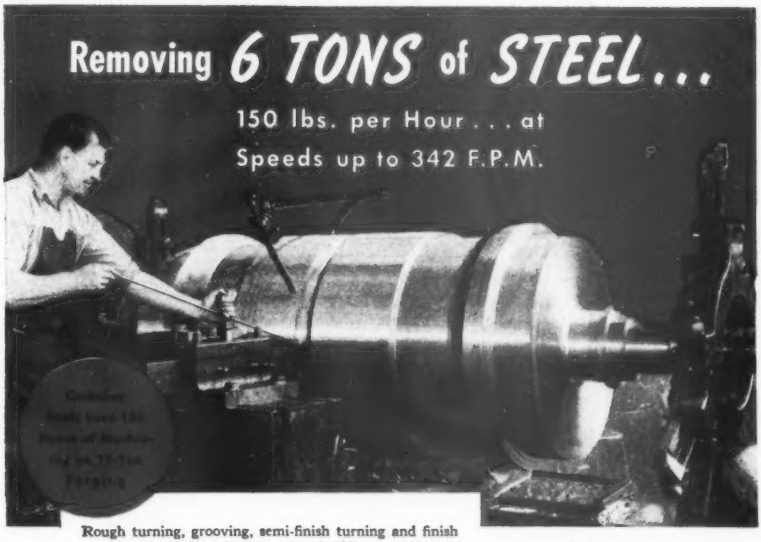
SUPER KOOL ... OIL-HOLE DRILL

Manufacturers of

Oil Hole Drills . . . . . Special Reamers
Circularity Relieved Reamers and End Mills
— *Also* Special Tools

Removing 6 TONS of STEEL...

150 lbs. per Hour . . . at
Speeds up to 342 F.P.M.



Rough turning, grooving, semi-finish turning and finish spacing, 12-ton forged steel rotors, for Navy turbines, is a job that's "tough" on tools. To complete these operations, six tons of steel are removed, with tools taking cuts often as deep as $\frac{3}{4}$". Indicative of the ability of Carboloy tools to step up steel cutting production on heavy work such as this is the performance of Carboloy Grade 78-B on this application. Operating at various speeds ranging up to 342 F.P.M., and feeds from .010" to .047" Carboloy tools remove 150 lbs. of steel per hour, completing the job in $3\frac{1}{2}$ days of actual machining time instead of the 11 days 4 hours formerly required.

Carboloy tools—with hardness ranging up to 92.5 Rockwell "A" and transverse rupture strength up to 295,000 p.s.i.—are designed for the entire range of steel cutting. There is a grade for every application on steel, whether your job involves heavy duty work—such as these rotors, or high-speed, precision finishing, holding tolerances as close as 0.0002".

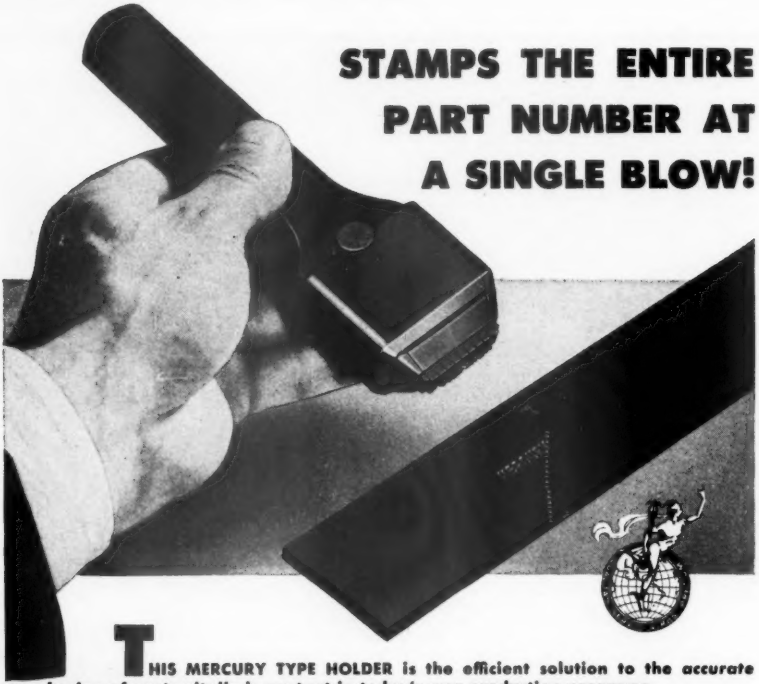
CARBOLOY COMPANY, Inc., Detroit, Michigan
11109 E 8 Mile Street
Birmingham, Alabama • Chicago • Cleveland • Los Angeles
Newark • Philadelphia • Pittsburgh • Seattle • Thomaston, Connecticut
Authorized Distributors: Canadian General Electric Co., Ltd., Toronto, Canada.
Foreign Distributor: International General Electric Co., Schenectady, N.Y.

Send for New, 16-page Vestpocket Manual on Steel Cutting with Carbides

10 Standard Stock Styles for Steel Cutting

CARBOLOY
(TRADEMARK) CEMENTED CARBIDES
For Cutting CAST IRON
For Cutting STEEL
FOR HEAVY HOGGING • • • PRECISION FINISHING • • • INTERMITTENT CUTTING

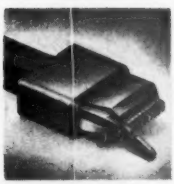
STAMPS THE ENTIRE PART NUMBER AT A SINGLE BLOW!

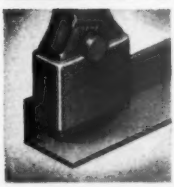


THIS MERCURY TYPE HOLDER is the efficient solution to the *accurate* numbering of parts, *vitally* important in today's war production programs . . .

It stamps the *entire* part number—up to 16 characters if needed—with just one blow of the hammer. One setting of the part number in the Holder enables you to mark as many duplicate parts as desired—quickly, accurately and neatly. It eliminates inefficiency and time lost using single-character stamps for each separate figure or letter, and all of the errors common to this method such as overlapping, wrong sequence, etc.

In addition, Mercury Type Holders offer you these outstanding features that insure faster, better stamping operations . . .





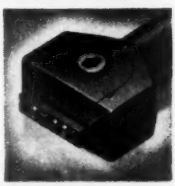
◀ **Interchangeable Type**—Changing type is a matter of seconds and involves no special knowledge or equipment.

▶ **Fool-proof Operation**—Special design features make it impossible to incorrectly place type in Holder.

◀ **Compact Construction**—Smaller parts can be neatly numbered because of unusually compact Holder construction.

▶ **Durable, Trouble-Free**—All steel *machined* construction eliminates replacements and repairs.

Available complete with hardened and ground hand-cut steel type in all popular sizes and in special models to meet specific problems. Descriptive folder—mailed free—gives details and specifications for both hand and press style Holders. Write Dept 12D for your copy.



MERCURY METAL DIE & LETTER CO., INC.

546 E. 16TH ST., LOS ANGELES 15, CALIFORNIA

Basic English

INSTRUMENTS FOR THIS DAY AND TOMORROW

Best of all the instruments used in the war plants today is the Broach (quickly-working toothed metal cutting instrument). For record-time hole making, cutting of metal, cutting smooth curves, machining inside and outside forms the Broach is an answer to today's needs in war industry. It is pointing to a future of ever sharper limits in machining, greater output and a wider range of operations — a future which will see the broach used in important developments in industry everywhere and the producing of better goods in all parts of the earth.

The Lapointe Broach (quickly-working toothed metal cutting instrument)

This advertisement is written in Basic English for international distribution.

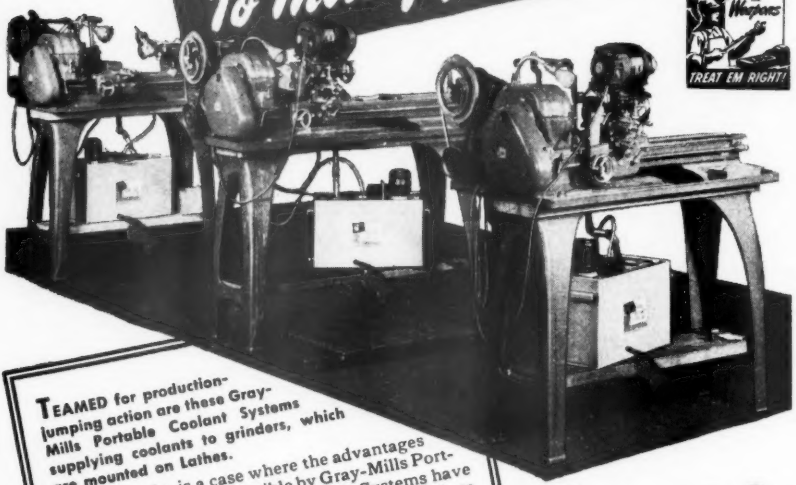
ARMY E NAVY

The LAPOINTE Machine Tool Company

HUDSON, MASSACHUSETTS, U. S. A.

GRAY-MILLS *Portable* COOLANT SYSTEMS

Supplying To Thirsty Grinders



TEAMED for production-jumping action are these Gray-Mills Portable Coolant Systems supplying coolants to grinders, which are mounted on Lathes.

Here, again, is a case where the advantages of coolants are made possible by Gray-Mills Portable Coolant Systems . . . Gray-Mills Systems have increased the efficiency of hundreds of machines on operations like drilling, milling, sawing, grinding, honing, tapping, threading and cutting. They are quickly and easily set up to operate either as a permanent or temporary part of a tool. Sturdily built Gray-Mills Coolant Systems are available in both gear and centrifugal types, with baffles and pump screens, and with capacities from 40 to 2,000-gal. per hour controlled flow. Prices range from $39.50 to $189.50.

In Gray-Mills Portable Coolant Systems you have the quick, easy, economical way to apply coolants to small and old machines, or machines with inadequate coolant systems.

Ask for a Gray-Mills demonstration. Call your distributor, or write direct. Send for Catalog.

GRAY-MILLS CO.
211 W. Ontario St., Chicago 10, Ill.

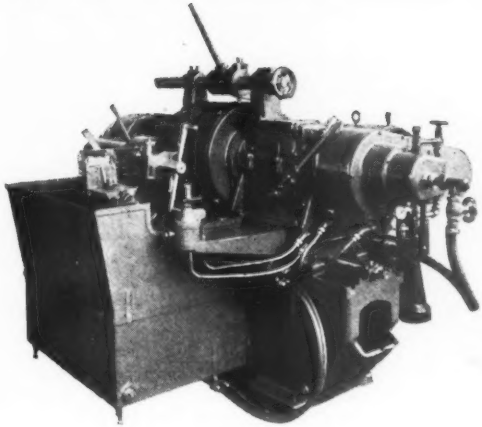
STANDARD HEAVY DUTY "A" SERIES
Large capacity tanks—forced settling baffles and screens—Capacities: centrifugal type up to 3,000 g.p.h.—gear type up to 165 g.p.h., pressures, 50 lbs. p.s.i.

MODEL "G" SERIES
Capacities up to 130 g.p.h.—pressure, 30 lbs. p.s.i.

Complete Portable Coolant Systems

Use GRAY-MILLS COOLANTS . . . 5 types for most requirements—10 and 55 gal. containers—immediate delivery from your distributor or our plant.

How the Well-Equipped Shop Handles PARALLEL SURFACE GRINDING JOBS



For full information on Besly Titan Steelbacs, send for this Booklet.

Grinding two parallel surfaces simultaneously is a common enough operation. But as handled in the well-equipped shop on a Besly Double Spindle Grinder the results are anything but common. The difference, in terms of better production, greater accuracy and lower operating expense, is Besly engineering experience.

Besly's experience, extending over half a century, explains the company's success in matching the right machine design and the right abrasive to each of many different grinding operations and metals, including the hardest of the modern alloys. This experience, plus Besly's outstanding record of continuing service to customers long after the initial sale, are sound reasons for consulting Besly engineers on any current and postwar grinding problems.

For Example . . .

The model 218-20 inch Besly Double Spindle Grinder shown delivers accurately ground work for long periods with infrequent maintenance. In this machine, the only parts to slide to and away from the work are the spindle, bearings and the special quill or sleeve in which they are mounted. The quill moves freely on a grease-tight slide. No grit, dirt or water can enter to cause wear—and consequent major overhauls. This basic design feature also permits locking the tie bar at the top in a fixed position, adding to machine rigidity and promoting accuracy of work.

BESLY

BESLY GRINDERS AND ACCESSORIES
BESLY TITAN ABRASIVE WHEELS • BESLY TAPS

CHARLES H. BESLY AND COMPANY • 118 N. CLINTON ST. • CHICAGO, ILL.

...You too can be ahead of schedule and your production out on time, if you install dependable Lima Gearshift Drives on your machine tools and other production equipment.

With Lima Gearshift Drives, you have flexibility of operation, speed, power and safety to do the big jobs required in turning out precision equipment for our armed forces.

Lima Gearshift Drives, adaptable to lathes, milling machines, drills, boring mills, shapers and all other machine tools and equipment requiring selective speeds, can help you in the "home-front" drive for accurate, faster, safer production.

Increased production will beat the Axis—LIMA will keep you ahead of schedule. Wire or write for address of Lima Engineering Service nearest you.

Large enough to successfully serve you, yet small enough to give personal attention to your needs.

THE LIMA ELECTRIC MOTOR CO.

870 Findlay Road

LIMA, OHIO

REPRESENTATION IN MOST PRINCIPAL CITIES

LIMA GEARSHIFT DRIVES - LIMA ELECTRIC MOTORS
LIMA MAGNETIC POLISHING LATHES - LIMA PEDESTAL GRINDERS

"Tenths" Are Here to Stay

There are shops today working to tolerances of tenths of thousandths that formerly considered 1/1000" a close measurement. The precision demands of war have made these tolerances a commonplace.

For this reason, because 1/10000" is being called for more and more, REED micrometers in the 1", 2" and 3" sizes will now be manufactured with 1/10000" vernier only AT NO EXTRA CHARGE. Even now micrometers reading to "thousandths" are often inadequate and may well become obsolete.

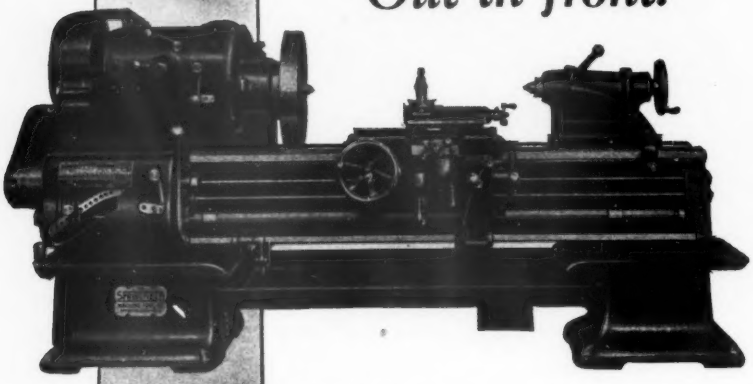
If you are working with micrometers reading to 1/1000" only, this is your opportunity to order a REED No. 901, as shown above, with vernier to 1/10000" for only $8.50 less 10%. The price is low but the quality is high. REED MICROMETERS HAVE BEEN MADE IN THE U. S. A. CONTINUOUSLY FOR 30 YEARS.

We have just published an 8-page folder about REED micrometers that you should have. Every man who uses a "mike" will find it of interest.

Write or telephone for this folder NOW!

SPRINGFIELD PRECISION LATHE

Out in front!



● Headstock . . . twelve speeds . . . only half of the easy-shifting spur gears mesh at one time.

Motors . . . V-Belt or silent chain drive. Bed . . . permanently true—made of high test alloy to resist warp or marring under severe service.

Apron . . . extra heavy—operates on Ball and Bronze bearings throughout.

Taper attachment . . . hair-trigger adjustment.

Compound rest . . . sturdy, firm.

Tailstock . . . all bearings and bed ways oiled from one well.

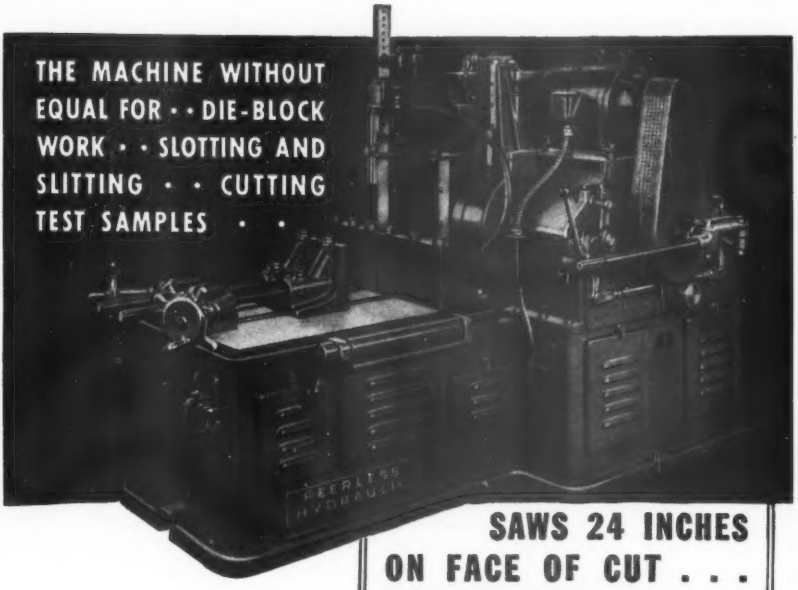
From headstock to tailstock—the SPRINGFIELD Lathe is ***out in front!***

SEND TODAY FOR BULLETIN No. 163

Tells the why and how of Springfield's accurate production.

THE SPRINGFIELD MACHINE TOOL CO.

SPRINGFIELD • OHIO, U. S. A.



SAWS 24 INCHES ON FACE OF CUT . . . CAN BE LOADED BY CRANE

PEERLESS is the only hydraulically controlled metal cutting saw that will handle 10 x 24 inch stock without turning the work. Only a few thousandths need be allowed for planing when the sawing is done on a Peerless Vertical! The large work table permits loading by crane.

Peerless is the only Vertical Metal Cutting Saw with full automatic, hydraulic control of the feed, blade lift, blade return and elevating rollers. Because Peerless cuts so true and square, critical stock is saved, enabling tool and die makers to use scrap pieces for smaller dies, strippers and stripper plates.

Mail the coupon for estimate of cutting time on your toughest operation and full details of the Peerless Vertical Metal Cutting Saw.

PEERLESS MACHINE COMPANY
1600 JUNCTION AVE. • RACINE, WIS.

Peerless Machine Co., Dept. TD-1243, Racine, Wis.
Mail cutting time estimate for.....
☐ Mail catalog on Hydraulic type Saw for High Production Cutting
☐ Mail catalog covering Vertical type used for Die Block Work
☐ Mail catalog on Mechanical type Saw for production cutting
☐ Mail catalog on general utility and maintenance Saws
Company.....
Individual.....
Street.....
City..... State.....

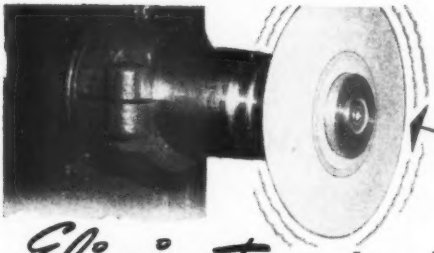
Peerless
THE ONLY METAL CUTTING SAW WITH FOUR-SIDED SAW-FRAME AND BACKING-PLATE

Tannewitz VARIABLE SPEED BAND SAWS Are Metal-Cutting EXPEDITERS!

Removing gates and risers from steel, cast iron, manganese, bronze, hard and soft brass, aluminum and magnesium castings, as well as many other metal cutting jobs handled with great dispatch and surprising savings on TANNEWITZ VARIABLE SPEED BAND SAWS. And since they are available in any 3:1 speed ratio from 100:300 to 1000:3000 blade feet per minute, with instant adjustment to intermediate speeds, one machine serves ideally for cutting a variety of materials. Made with 30", 36" and 42" wheels.

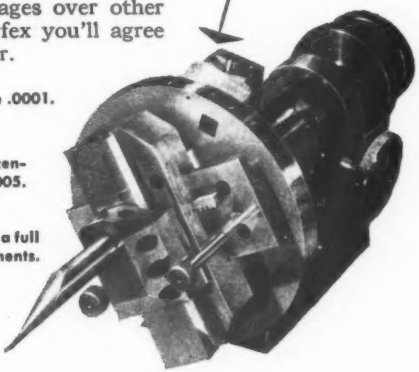
Other models (single speed) for such purposes as sawing large blocks of aluminum and magnesium, cutting large steel templates, etc., are available in capacities and speeds to ideally accommodate work of practically any size or character. For complete facts write for bulletin on Variable Speed Band Saws. Also on request, bulletins on: Sheet Metal Cutting Band Saws; DI-SAWS, combination band saws for sawing, filing and polishing.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICHIGAN



Eliminate wheel chatter by dressing your wheels with this PERFEX DRESSER

Don't let wheel chatter cause poor finish on gaging surfaces. Dress your wheels with this newly developed Perfex Angle Tangent to Radius Dresser. It is claimed by users to be the most *accurate* dresser made. Its features show that the Perfex has distinct advantages over other dressers. Once you try this Perfex you'll agree it's what you've been looking for.



- ★ **Radius can be set accurately to within .0001.**
- ★ **It is possible to return the diamond to center after dressing an angle within .00005.**
- ★ **Can dress a smaller than .050 radius to a full half circle without additional attachments.**
- ★ **Very rigid construction.**
- ★ **Diamond automatically locates on center.**

The Perfex Angle Tangent to Radius Dresser was designed by gage makers for gage makers. That is why this dresser meets the exacting requirements demanded by gage manufacturers —and that is why it will pay you to write for descriptive literature today.

IMMEDIATE DELIVERY

Perfex Dressers are being delivered promptly when orders are accompanied with necessary priorities.

PERFEX DRESSER CORPORATION
3607 GAYLORD . DETROIT, MICHIGAN

NOW you can RECLAIM HIGH SPEED STEEL TOOLS by WELDING right in YOUR OWN PLANT!

with Suttonite No. 1 AND A NEWLY DEVELOPED No. 2

The Welding Equipment & Supply Co. (originators of "SUTTONIZING", the first successful welding process for reclaiming HSS Tools) announce their recent development of SUTTONITE No. 2 Drawn Alloy Welding Rods, which with SUTTONITE No. 1 now make it possible for you to reclaim your high speed steel cutting tools by welding right in your own plant.

This announcement is of vital importance for, with SUTTONITE No. 2 the customary hazards experienced in the welding of broken HSS cutting tools has been eliminated. If you want to repair those broken tools in your plant it will pay you to wire or write for complete information today.

★

Here's the booklet that tells all about SUTTONITE No. 2 and how to use it in your plant. Don't fail to send for it today!

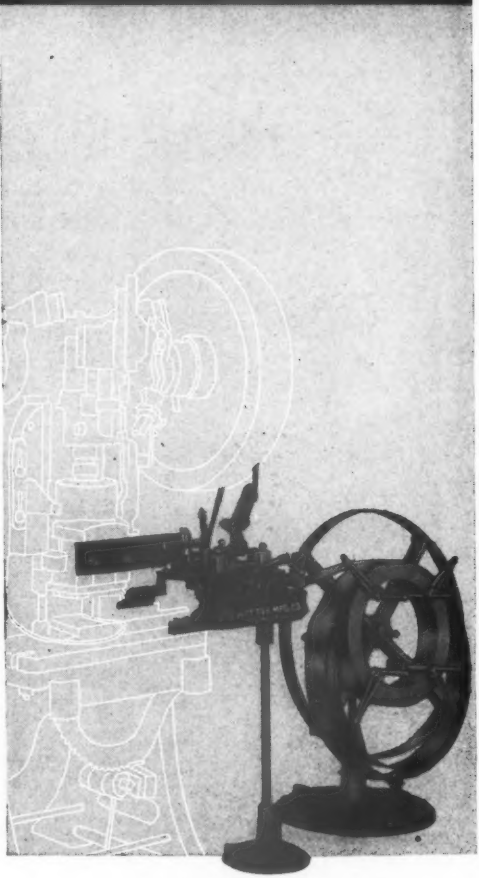
Distributors in principal cities of the United States and Canada.

WELDING EQUIPMENT & SUPPLY CO.
223 LEIB STREET • DETROIT, MICHIGAN

Our Punch Presses Are More Flexible And Productive With WITTEK *Automatic* Roll Feeds And Reel Stands

Manufacturers of metal stampings facing problems in the feeding of coiled strip stock to punch presses will find that Wittek Automatic Roll Feeds and Reel Stands conserve man-hours and achieve new high production levels.

Providing an improved and simplified method of punch press operation, Wittek Automatic Roll Feeds and Reel Stands insure rapid, safe and accurate feeding under all conditions. Made in four different types to meet all automatic feeding requirements. Write for complete details. Wittek Manufacturing Co., 4305-15 West 24th Place, Chicago, Ill.



ARMY E NAVY

WITTEK WMCo *Automatic* ROLL FEEDS and REEL STANDS

For All Makes and Sizes of Punch Presses

NEED *Special Service* ON SPECIAL DIE SETS? *Call* "DETROIT"

In addition to making a complete line of standard die sets, we are especially well equipped to produce special die sets to your specifications. Send us your prints for prompt action—or call the "Detroit" man in your area.

DETROIT DIE SET CORPORATION
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SAN FRANCISCO	MA 8532
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DETROIT DIE SETS ★

Need Bushings?

YEARS ago, Ex-Cell-O standardized for American industry, different styles and types of drill jig bushings—Ex-Cell-O is now, as always, a dependable source of supply.

EX-CELL-O CORPORATION • DETROIT

—*Try* EX-CELL-O *First*

SAVE PRODUCTION TIME

with a

SHOPLIFTER

One man can handle heavy dies alone. Not necessary to stop other machines to get help.

MORE production per day from your machines if a Shoplifter is handy to do the heavy job of moving dies from storage racks to the press. In these times when maximum production of machines is of vital importance, much time and labor can be saved if the operator can handle the heavy work of changing dies without calling for help from other operators.

The Shoplifter is built for this job. Dependable and safe with a rated capacity of 500 lbs. (heavier machines up to 5000 lbs. can be furnished). Entire machine built of structural steel. Electrically welded throughout. Platform lifts 54" above floor and lowers to within 5½" of floor. Overall height 72". Size of platform 24"x24" wood deck. Crank, up and down, hoist unit.

ECONOMY ENGINEERING CO.
2659 W. Van Buren St., Chicago, Ill.

Price **$147.50**

IMMEDIATE DELIVERY

OTHER SUPER CARBIDE TIPPED TOOLS FOR

Turning, Facing, Reaming, Spotfacing, Forming, Grinder Rests, Wear Parts, Boring, Drilling, Grooving, Counterboring, Shaving, Centers and Special Purposes.

Of course he's satisfied! Like most production men who use Super Carboloy-Tipped Milling Cutters, he is getting faster, more accurate and more economical milling production. He is typical of users throughout the country who report such amazing production records as these . . . "With Super Milling Cutters we decreased the cutting time on one job 200%." "On a bronze alloy job we increased the number of pieces per grind 700%." "On a steel milling job we now complete a standard run in 2 hours that formerly took 8 hours."

Other users of Super Carboloy-Tipped Milling Cutters will tell you that in cast iron and non-ferrous materials they can run at machine capacity with feeds of .002" to .005" per tooth. In steel with tooth loads of .0005" to .0025" they can run at surface speeds of 400 to 800 feet per minute. That's performance you shouldn't overlook in times like these!

Why not learn more of the advantages of these milling cutters that are establishing new records in speed, accuracy and economy on all types of milling operations? Let us send you a descriptive folder.

(All sizes available for early shipment)

SUPER TOOL COMPANY

Carbide Tipped Tools

21650 Hoover Road, Detroit 13, Michigan ★ 4105 San Fernando Road, Glendale 4, California

STEEL STAMPS AND DIES

For embossing and stamping lettering
and designs on all products

Master hobs and cavities
for all insignia and
buttons.

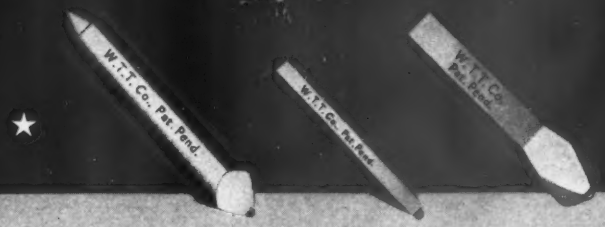
Sossner **STEEL STAMPS** for
every marking purpose
... for use by
hand or machine.
A 33 year reputation
for precision workmanship
on dies and stamps.

ALSO: TAPS • GAGES •
CUTTING TOOLS

SOSSNER

161 Grand Street • New York, N. Y.

UP Goes Production!
DOWN Go Grinding Costs!



No Wonder Production Men Specify This New TRU-THREAD DIAMOND DRESSING TOOL!

THE proof of the performance and economy of this new TRU-THREAD Diamond Dressing Tool is found in the cost and production records of users throughout the country . . . production increases in one plant up to 500% and reductions in per-piece grinding costs as much as 75%.

It's no wonder! Made with a natural fine quality uncut diamond specifically selected for the job, this tool cuts exceptionally clean. It obtains forms faster. Fewer dressings are required. Down time is reduced because more work can be ground between dressings.

The diamond is of a shape that permits angle, radial and multiple form as well as straight dressings. And because this tool can be made and reserviced on a production basis, quick deliveries are assured.

Learn more of the advantages of TRU-THREAD TOOLS. Write or wire for detailed information today.

***FOR USE ON*—Excello, Jones & Lamson, Dalzen and all other thread grinding machines.**

WHEEL TRUEING TOOL CO.

3200 W. Davison Avenue Detroit 6, Mich.

The Diamond Grip
Stops the Slip
HOW TO GET
MORE WORK
from your
OLD
MACHINES
Get a Sutton Master Collet and a Master Feeder for each automatic. We'll recommend an assortment of interchangeable, replaceable pads that will handle all your work—round, hex or square—up to machine capacity.
Sutton full-floating Collets eliminate trouble with hot-rolled stock. Sutton patented Diamond Grip Collets cost no more than ordinary collets, but enable you to speed up machine cycles to the capacity of the tools. Sutton Draw-bars and Adaptors enable your old lathes to handle full length bar stock.
SUTTON TOOL COMPANY
2895 W. GRAND BLVD., DETROIT, MICHIGAN
See our representative or send for Catalog 15.
SUTTON
Diamond Grip
COLLETS

. . . AND IT'S THE FINISH THAT'S IMPORTANT!

IN at the finish of innumerable industrial operations these days are the versatile "MX" Wheels, introduced only a little over a year ago by Carborundum. Burrs, tool marks and other "disturbed metal" resulting from grinding, machining, boring and similar operations are removed in a jiffy. They are ideal for breaking corners and polishing grooves and slots. Surrounding surfaces are kept free of abrasive marks, and tolerances are maintained because of light stock removal.

Vibration and chatter are reduced to a minimum because of the cushioning action. Yet they cut free and clean, and no coolant is used. "MX" Wheels, unlike any other abrasive product made are built up of abrasive grains intermingled with cotton fibres and held together with a suitable binder. For further information write Dept. TD. The Carborundum Company, Niagara Falls, N. Y.

CARBORUNDUM
ABRASIVE PRODUCTS

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

REG. U. S. PAT. OFF.

MANUFACTURERS OF GRINDING WHEELS, COATED ABRASIVES, SUPER REFRACTORIES, HEATING ELEMENTS

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)

Use COLMONOY

HARD FACING ALLOYS AND OVERLAY METALS

Your production schedules would be mighty easy if your equipment never wore out.

When machinery wears to the point that it is useless for its particular function, you will find that the wear is localized—one place wears out before the rest.

Coat these critical places with the proper grade of COLMONOY. The application is easy to make, by standard welding methods. You will find that parts so treated will give service many times as long as will uncoated parts. Worn and discarded equipment, when hard-faced with COLMONOY, not only goes back to work, but outwears and outperforms new, uncoated equipment.

Our new Catalog No. 75 gives full information on all grades of COLMONOY and shows pictures of many types of application in different industries. Write for your copy today.

Catalog No. 75 mailed on request

WALL - COLMONOY CORPORATION

Offices in Detroit, New York City, Blasdell, N. Y., Chicago, Tulsa, Los Angeles, San Francisco and in Canada.

WALL-COLMONOY CORP.

720 Fisher Bldg., Detroit 2, Michigan

Precision Grind CUTTERS AND END MILLS

Girl operator precision grinding ½" dia. 2-Flute High-Speed Steel End Mills, sharpened to a 15° cutting angle. Total time required to grind cutter from hardened and ground blank is 5 minutes per cutter.

TYPICAL EXAMPLE OF CUTTERS GROUND ON THIS GORTON GRINDER

Shown are a few examples of the wide range of cutter grinding accomplished on the Gorton 375-2.

Save Time and Money . . . with a GORTON CUTTER GRINDER

This manufacturer has four Gorton 375-2 Cutter Grinders for sharpening cutters and mills used on a number of precision machines, including three Gorton Pantograph Engravers and a Duplicator.

Girls operate all four grinders. It requires only about two months to develop a girl's skill sufficiently to perform the most critical grinding operations on most types of precision cutters and end mills.

OUR GOLDEN ANNIVERSARY 1893-1943

ACCURATELY GROUND TOOLS are indispensable to Super-Speed precision milling. The Gorton 375-2 Cutter Grinder grinds cutters with 2, 3 or 4 flutes, or flats . . . any diameter, taper, radius or clearance within the capacity of the machine. With diamond impregnated wheels (interchangeable with standard wheels), tungsten carbide cutters can also be ground.

Install a Gorton 375-2 Cutter Grinder for increased accuracy and production with smoother finish in your milling operations.

COMPLETE SET OF CUTTERS AND END MILLS WITH FREE HANDY CUTTER RACK FURNISHED

This convenient rack is furnished free with assortments of Gorton Cutters and End Mills. Saves time and money on mold and die work.

No. 375-2 Grinder, equipped with No. 717-1 Universal Tool Head and No. 9761 Pedestal, complete, ready to operate..... **$612**

FREE

For complete details and additional accessories write for *Gorton Accessories Catalog* offering 580 aids to production.

GEORGE GORTON MACHINE CO.

1319 RACINE STREET, RACINE, WISCONSIN, U.S.A.

FOR OVER 50 YEARS Specialists in "Tracer-Controlled" Machines

Jessop High Speed Steels
are giving outstanding performance in machining and cutting operations on parts for all types of war equipment.
★ SUPREMUS
18-4-1 Type
★ PURPLE LABEL
18-4-1-5% Cobalt
★ PURPLE LABEL EXTRA
18-4-1-8% Cobalt
★ MUSTANG
5-5-2 Type
★ MUSTANG SPECIAL
5-5-2-5% Cobalt
★ MOGUL
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Established 1901
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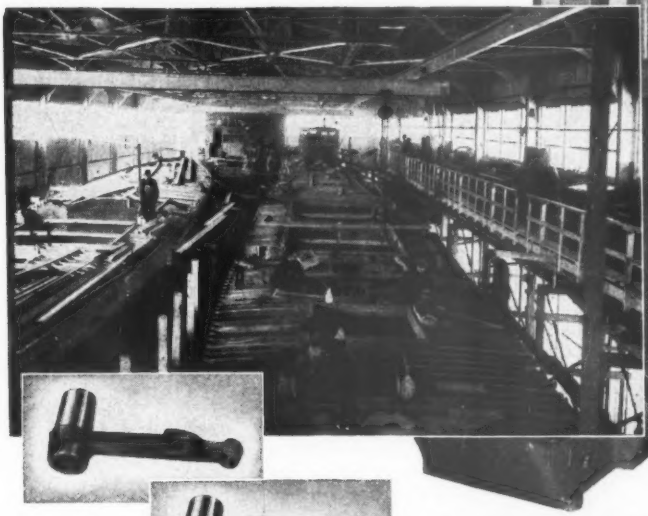
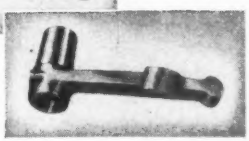
HEAD OFFICE AND WORKS WASHINGTON . . . PENNA.

LINES BEHIND THE LINES

CONVERTED FROM PLEASURE CRAFT TO P-T's AND S-C's, THE BOATING INDUSTRY BUILDS AT TOP SPEED FOR VICTORY!

Keeping pace with the Kaisers and other miracle workers in the shipyards, the small boat builders are placing the emphasis decidedly on speed. Yet the highly efficient machinery in the boats they are building also puts a premium on accurate parts fitting. To secure this production-with-precision the boating industry relies heavily on broaching. Broaching—a better way to do many metal working jobs — is the only *right* way to do some!



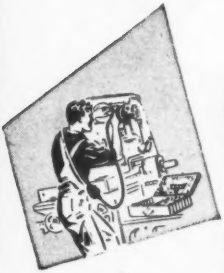


Using an American Type T Three-Way Broaching Machine, top and bottom faces are finished on the rocker arm shown in before and after views above. Many marine products — including parts for motors, transmissions, armament, and electrical systems—are broached economically with American equipment. American's *complete* broaching service — machines, tools, and engineering — makes war production more efficient, post-war production more profitable.

BROACHING IS BETTER THE *American* WAY

American
BROACH AND MACHINE CO.
ANN ARBOR, MICHIGAN
BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY
DIVISION OF

Foredom FLEXIBLE SHAFT MACHINES can serve you 3 ways!



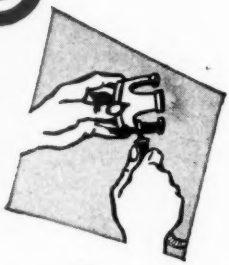
1

For maintenance and emergency needs such as touching up production set-ups without disassembly, removing high spots on gears, identification marking of products and equipment, etc.

★

2

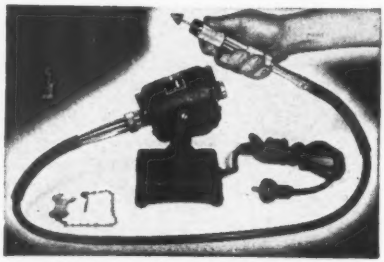
In die and tool departments, for grinding, finishing and touching-up dies, molds, jigs, etc.



3

For de-burring, grinding, finishing, polishing and other light production jobs — particularly valuable on irregularly-shaped parts.

★



Bench and suspension models available. FOUR types of handpieces, including pencil size.

No matter what kind of equipment you have — no matter what type of work you do — Foredoms can boost your production! Ford, General Motors, Bendix, Westinghouse, Warner, Allis-Chalmers, Remington Rand, Curtiss-Wright and many other leading war plants are equipped with Foredom Flexible Shaft Machines! Foredoms eliminate many types of old-fashioned, time-consuming hand work and thus speed up production. Foredoms are just as ready to "pinch hit" in emergency breakdowns. Models from $17.50 to $48.75.

Our catalog No. 430, just off the press, shows the many uses of Foredom Flexible Shaft Machines in many different kinds of industries. Find out how a Foredom can help solve today's production and maintenance problems in your plant. Send for this catalog today.

Foredom

FLEXIBLE SHAFT MACHINES

SOLVE MANY PRODUCTION AND MAINTENANCE PROBLEMS

FOREDOM ELECTRIC CO. 27 PARK PLACE, NEW YORK CITY

Foredom Electric Company,
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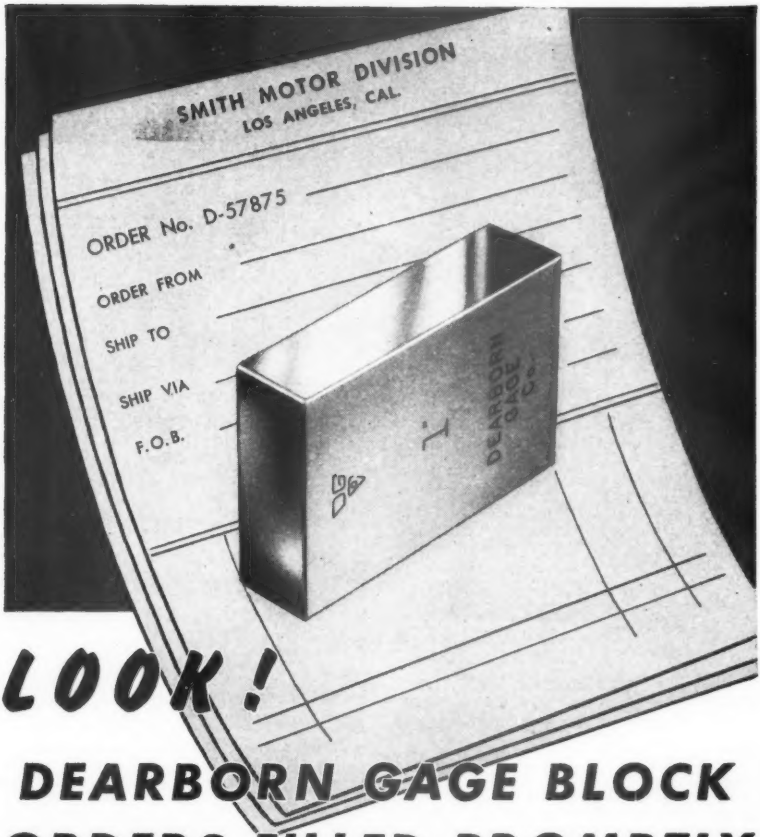
New York 7, N. Y.
Please send us your new catalog No. 430 showing the different uses of Foredom Flexible Shaft Machines.

Name .....
Address .....
City .....
State .....



LOOK!

DEARBORN GAGE BLOCK ORDERS FILLED PROMPTLY

The Dearborn Gage Company has increased their production in order to better facilitate deliveries of their gage blocks. It is now possible to make a definite promise on their complete sets or individual blocks. For complete information as to delivery dates and prices on Dearborn's Chromium Plated Gage Blocks, wire or write us today.

DEARBORN GAGE CO. 22035 BEECH STREET DEARBORN, MICHIGAN

Originators of Chromium Plated Gage Blocks

Retracting and Repositioning Work Within .0002 OF AN INCH—By Push Button

The most frequently needed function in a precision boring machine is that of retracting the work to facilitate measuring and tool setting.

In the DeVlieg Jigmil, this function is automatic—by fingertip control. Operation of a push button unlocks the table and moves it by rapid traverse to the desired position for measuring. For repositioning, operation of a single push button will cause the table to return to its cutting position by rapid traverse, stopping and locking automatically. Uniformity of selected position for stopping and locking is dependable within .0002".

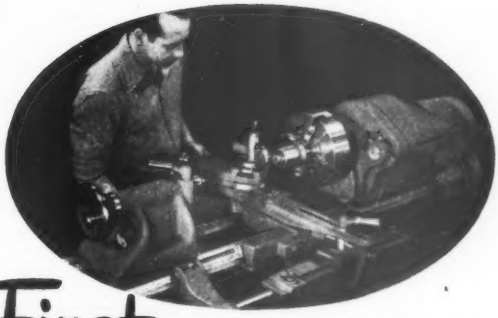
The DeVlieg Jigmil is a new type machine—has the spacing accuracy of a Jig Borer—Performance Qualities of a Milling Machine—Convenience and Flexibility of a Horizontal Boring Mill. All control is so centered and organized that the operator never has to take his eyes off the work.

Thus, the Jigmil fulfills the machine tool ideal—a powerful and accurate extension of the operator's hand.

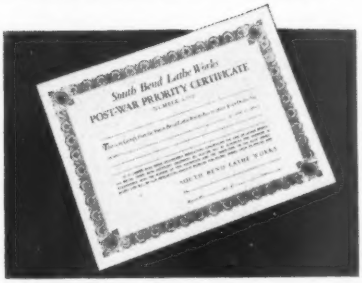
Many machines show 75 per cent greater average daily productivity.

DE VLIEG MACHINE COMPANY
450 FAIR AVE. FERNDALE (DETROIT) MICHIGAN

Write for Circular
DEVLIEG MACHINE TOOLS



Be First ON THE POST-WAR PRIORITY LIST for South Bend Lathes



Post-war employment and prosperity depend upon quick resumption of normal peace time civilian activities, production, and services. To furnish lathes first to those who will be ready to use them (but cannot qualify for a war-time priority) South Bend Lathe Works now offers a practical post-war priority plan.

To take advantage of this plan, place an order now for the lathes you want. No down payment, no deposit is required. Should conditions necessitate, you may cancel the order at any time. All we ask is that it be placed in good faith.

When your order is received, we will issue a numbered Post-war Priority Certificate. As soon as materials and manpower are released for civilian production, South Bend Lathes will be shipped in accordance with the Priority Certificates. Certificate holders will receive the first South Bend Lathes to be thus released, up to 80% of our production. The remaining 20% will be reserved for returning service men who may need lathes.

All standard South Bend Lathes, embodying the improvements developed in meeting exacting war production needs, will be available. No revolutionary models or design changes are to be expected. There will be no price increase—unless material or labor costs, or other conditions beyond our control, require it.

Here is a practical first step in putting your post-war plans into action. South Bend Lathes are made in a variety of sizes and types, 9″ to 16″ swings. Send for Catalog No. 100-C and full information on this plan. Choose the lathes that meet your needs... place an order now, and be sure of earliest possible delivery.

Buy War Bonds Now... Save for Lathes

SOUTH BEND LATHE WORKS

South Bend 22, Indiana — Lathe Builders for 37 Years

OUR JOB

Helping Toolmakers Over Tough Spots

What's a tough spot for a toolmaker? It could be an error in machining that would immobilize a sorely needed tool.

Or it might be the time you cannot find for replacing a worn tool.

For just such an impasse, let Hartford Chrome come to the rescue!

It's a matter of teamwork between toolmaker and plater. Hartford Chrome speeds production every day by correcting errors — salvaging rejected parts — rebuilding old ones.

Tools, gages, airplane crank shafts, gun parts, propeller and impeller shafts, ammunition punches and dies are part of a long list being plated successfully here — for an equally long list of leading manufacturers.

If you are in the territory served by Hartford Chrome (*see map*), a letter or phone call will bring a capable service engineer, with samples and full details.

FREE LITERATURE

Write for reprint of trade paper article "How Hard Chrome Plating Can Aid Your War Effort".

WE SERVE NEW ENGLAND, NEW YORK & NEW JERSEY

HARTFORD CHROME CORPORATION

525 PARK STREET • PHONE 2-6868
HARTFORD, CONNECTICUT
Licensed by United Chromium

ARE YOU *in the* MIDDLE

ON TOOL ENGINEERING?

Is the production department "crying" for jigs, fixtures, gauges, etc. on **"those recently completed blueprints"** — or the front office repeatedly asking you to **"get going on that proposition discussed weeks ago"**—while you and your department are *up to your eyebrows* in other pressing work?

You can place much of this responsibility upon McKinney as many outstanding manufacturers have done repeatedly.

This organization of several hundred specialists will: design tooling to your blueprints and build them, if desired — produce jigs, tools, etc. to your completed designs — and in some instances produce the precision parts in our completely equipped plant.

A bulletin explains our services and facilities. Write for it, or better yet, ask a McKinney representative to call and discuss your particular needs.

McKINNEY TOOL & MFG. CO.
CLEVELAND

DESIGNERS *and* BUILDERS *of* PRECISION TOOLING
Since 1920

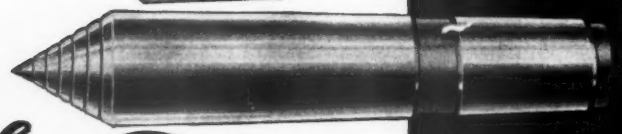
1673 ARABELLA ROAD

Tools · Dies · Jigs · Fixtures · Special Machinery

for CLOSE TOLERANCES

RIGID SUPPORT
No balls, rollers, or races to wear out and cause uneven tooling.

BETTER LUBRICATION due to exclusive helical groove*



Use CMD Helical Groove CENTERS AND CMD CENTER POINT OIL

★ The exclusive left hand helical groove in CMD Centers holds a reserve supply of lubricant and conveys it constantly to the extreme point of center. No burned out centers! No stopping machine to relubricate centers!

When CMD Helical Groove Centers are used with CMD Center Point Oil, they can be drawn up tight against the work, permitting closer tolerances and finer precision results. Send coupon now for details and FREE sample kit of the oil.

Write for FREE Sample Kit

CHICAGO MANUFACTURING & DISTRIBUTING CO.
Dept. 12TJ, 1928 West 46th St., Chicago 9, Ill.

Without obligation please send us a free sample kit of one tube of CMD Center Point Oil and one tube of CMD Center Point Lube. Also send Catalog describing CMD Helical Groove Centers.

Mr. .....Position .....

Company .....

Address .....

City .....State .....

CUTS JIG-BORING TIME 25%!

Read What Chief Tool Engineer Kennedy of Norge Division, Borg-Warner Corporation Says About

CENTERSCOPE

"We have found the Center Scope purchased from you several months ago, to be a very valuable addition to our tool room equipment.

"We have cut our jig boring time at least 25% which has avoided the necessity for sending any boring to outside shops.

"By having the bench men lay out their jigs and dies with a height gage or Johannsen Blocks and turning the job over to the boring mill hands, we have maintained closer limits on spacing and eliminated mistakes entirely.

"Spacings within .001 are easily attained and closer tolerances are possible.

"The tool makers are all enthused about this instrument and join in our recommendation of it."

Yours for Victory!

NORGE DIVISION
Borg-Warner Corporation

G. P. Kennedy
Chief Tool Engineer

Speeds Locating ...Makes Accuracy a Habit!

BETTER work at lower costs — is the universal report from shops using Center Scope, the optical locating tool. Job time estimates are being reduced, because Center Scope makes locating time shorter and gets more work out of each machine tool, from bench drill to lathe or jig borer.

Center Scope can be used without technical knowledge or training, and produces accuracy of plus or minus .0001" or better, the first time an operator uses it.

Used on any machine tool, it is a precision instrument, not affected by wear, temperature, or mechanical pressure.

Prices are attractive, too. Variable Center Scope, only $97 f.o.b. Milwaukee; Edge Block, $23 additional. For full information, write for Bulletin No. CS301.

Rotary Head Milling Machine
Autometric Jig Borers
Center Scope

Kearney & Trecker
Products
CORPORATION
Milwaukee, Wisconsin
Subsidiary of Kearney & Trecker Corporation

Milwaukee Face Mill Grinder
Milwaukee Midgetmill
Milwaukee Speedmill

Immediate Shipment
STEEL BOXES
FOR YOUR PRODUCTION NEEDS

STYLE 200 STRAIGHT SIDE SHOP BOX

A straight side shop box with drop handles each end. Excellent for shop use where stacking feature is not required.

No. 201	6" x 9" x 3½"	20 ga.	$.40 Ea.
No. 202	8" x 12" x 4"	20 ga.	$.45 Ea.
No. 203	9" x 13½" x 4½"	19 ga.	$.60 Ea

STYLE 300 STACKING BOX

Just right for your small parts. Light in weight, easy to handle. Equipped with drop handles each end. Runners save wear on bottom of box and act as positive stacking lock.

No. 301	6" x 9 " x 3½"	20 ga.	$ .55 Ea.
No. 302	8" x 12 " x 4 "	20 ga.	$ .60 Ea.
No. 303	9" x 13½" x 4½"	19 ga.	$ .75 Ea.

STYLE 700 STACKING BOX

A light weight box designed for quick identification of contents. Will stack with No. 303. Finished olive green enamel, baked on.

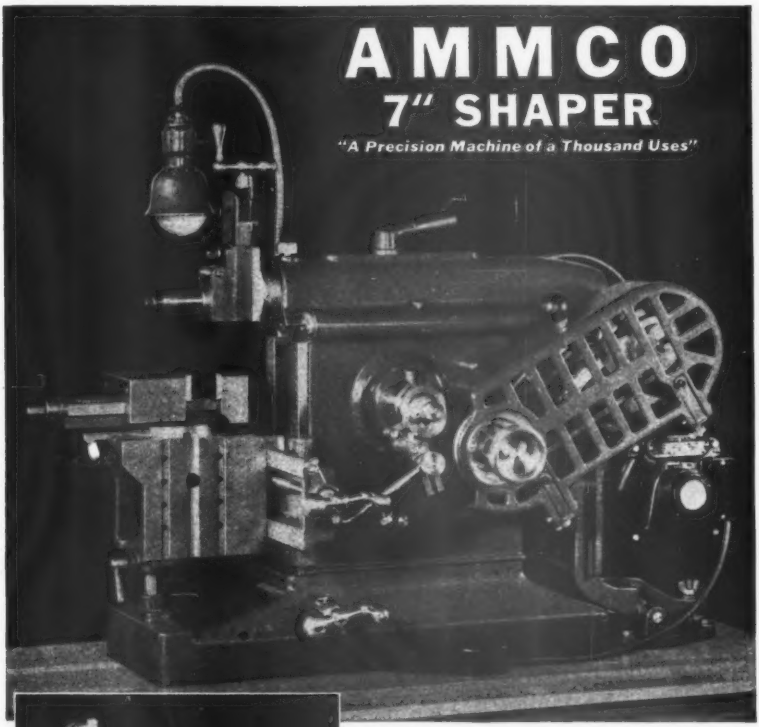
No. 703	9" x 13½" x 4½"	19 ga.	$.95 Ea.

Prices F.O.B. Factory, Phila.—Any Quantity

AMERICAN METAL WORKS, INC.

1531 Germantown Avenue — Philadelphia 22, Pa.

AMMCO
7" SHAPER
"A Precision Machine of a Thousand Uses"



IT'S PORTABLE

- **Saves time and steps!**
- **Can be moved from job to job in tool and die shop!**
- **Just wheel up to bench--plug in--and go to work!**

On jobs requiring a stroke of 7" or less, the AMMCO 7" PRECISION SHAPER will enable you to save a lot of time and expense in a set-up which would be required for larger shapers. Furthermore, the AMMCO will enable you to get away from the cost of operating a big shaper on small work.

Portable Cabinet model enables this shaper to be moved about the shop.

•

Write today for specifications and prices

ARMY E NAVY

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Ave.—North Chicago, Illinois, U. S. A.

OUR STORY IN PICTURES LEAVES NOTHING UNTOLD

★

★ Within fifty-six pages, profusely illustrated is as much of the story of the adaptability, economy and efficiency of overhead handling with AMERICAN MONORAIL EQUIPMENT that can be told without personal consultation.

If you are interested in producing more war material and at the same time preparing for post-war activities, do two things. First, send for American MonoRail Picture Book, see how this equipment is efficiently serving hundreds of handling jobs. Second, send for the American MonoRail Engineer to show you additional advantages to your individual problem. Write for your copy today!

THE AMERICAN MONORAIL CO. 13131 ATHENS AVENUE CLEVELAND 7, OHIO

When the chips are heavy

STATE REAMERS

COME THROUGH WITH INCREASED PRODUCTION

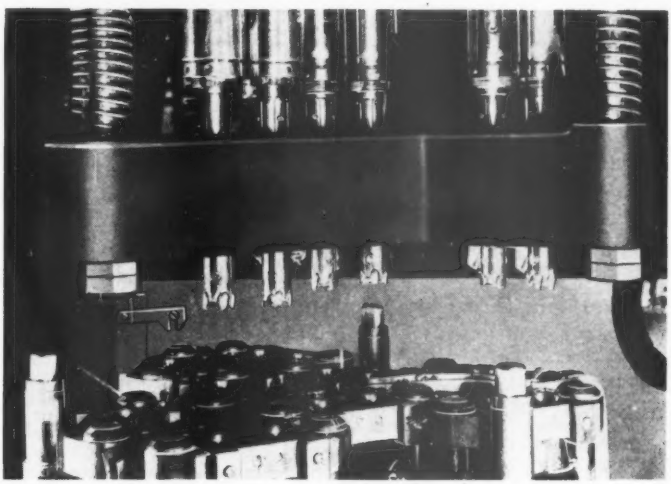
STATE Tools are noted not only for their unusual chip clearance but for many other features including:

1. **Quick, accurate, single-screw adjustment.**
2. **Unusual Bit Expansion insuring many regrinds.**
3. **Easy regrinding.**
4. **Solid, sturdy holders of heat treated alloys.**

Standard tools are made in 19 sizes to handle 7/8" to 5½".

If our standard models do not meet your needs special tools embodying STATE'S exclusive features *will* solve your problems. Proposals promptly submitted.

A modern high-production plant insures prompt delivery and reasonable prices.

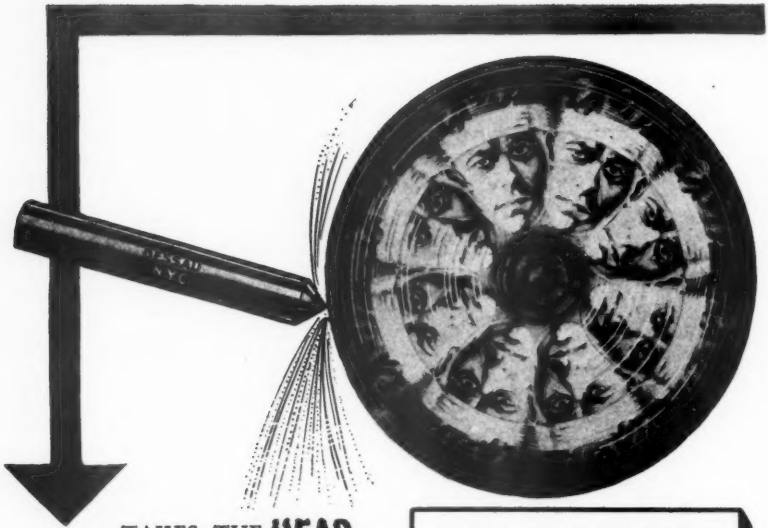


★

STATE MANUFACTURING & CONSTRUCTION CO.

FRANKLIN, OHIO

. . . THE RIGHT DIAMOND TOOL !!!



. . . TAKES THE **HEADACHE** out of the toughest wheel dressing job. DESSAU DIAMOND TOOLS are *right!* Every diamond must pass the most rigid tests for hardness, shape and construction before it is set into your specific type of tool.

We invite your inquiries and the privilege of helping you solve your diamond tool problems.

Available for Prompt Delivery

- **Single Stone Dressing Tools**
- **Multiple Point Diamond Tools**
- **Shaped Diamond Tools**
- **Phonopoints for Fine Radius Dressing**
- **Thread Grinding Tools**
- **Hardness Tester**
- **Diamond Powder**

Dessau Diamond Dressing Tools are recommended for use on Cincinnati, Landis, Norton, Heald, Brown & Sharpe, Excello, etc., grinding machines.

Write for newest catalogs and price lists.

MAURICE S. DESSAU CO.

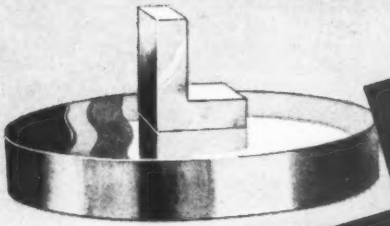
Industrial Diamond Importers • *Diamond Tool Manufacturers*

535 FIFTH AVE. • [illegible] • **NEW YORK, N. Y.**

Dessau Diamonds True the Wheels of Industry

A NEW WORD FOR

Precision Inspection



OPTI-FLATS
(Optically Polished Glass)

LOW COST MASTER
Surface Plates
AND TOOL MAKERS' KNEES

TOLERANCES
(Over complete surface)

FLATS
12" and 16" dia.
(2 and 3 ins. thick)
Grade 1 ..... .00005"
Grade 2 ..... .0001"

TOOL MAKERS' KNEES
(Faces 2½"x4"—2½"x3")
Grade 1 —
30 seconds of angle
Grade 2—
1 minute of angle

Flats and knees polished to closer tolerances available.

Today, our optical division production is largely War Work. We invite your inquiries for optical requirements for present needs or postwar manufacturing. WRITE TODAY.

6 outstanding advantages

1. Accuracy checked by light interference.
2. Coefficient of expansion approximately 2.8 times lower than that of plate glass and 2.9 times lower than that of cast iron.
3. Scratches do not effect accuracy—no burs.
4. If desired, high polished surfaces can be supplied, giving visible proof to operator of millionth inch contact of Johansson guage block.
5. No rust, warpage, degreasing, demagnetizing, oiling or wringing.
6. Quality guaranteed.

OPTICS DIVISION

BINSWANGER & CO.

OF TENNESSEE
Memphis, Tenn.

BRANCH DIVISIONS THROUGHOUT THE SOUTH AND SOUTHWEST

"Serving Glass requirements for 72 years"

Versatile . . .

THE NORTON
MULTIPURPOSE GRINDER

THE Norton Universal Multipurpose Grinder finds its particular field of utility in miscellaneous, small-lot general production or in tool room work. Its standard equipment gives it a versatility to handle a diversity of work without difficulty of set-up or wastage of production time.

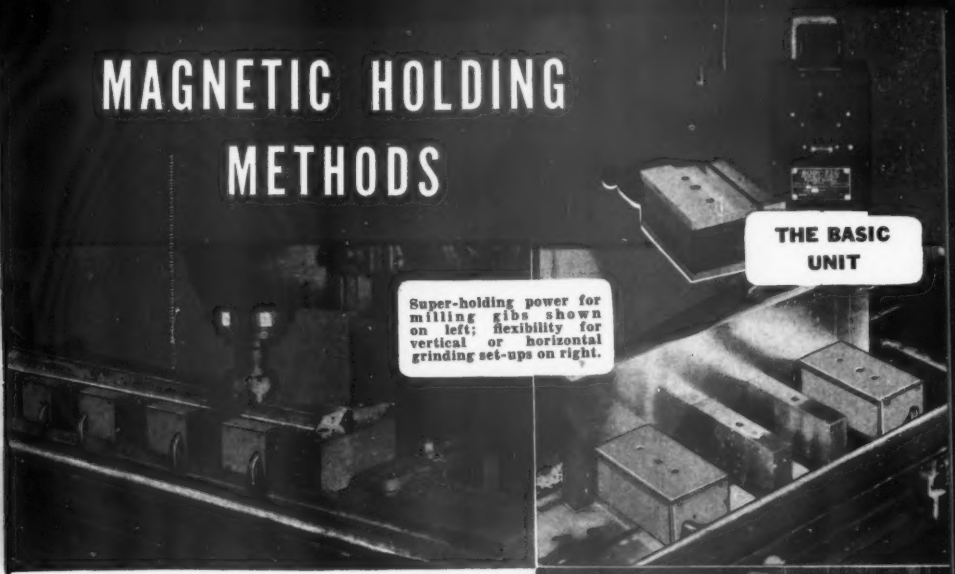
Its construction is such that it has a long life of accurate and rapid production. The massive base has maximum stability and lends rigidity to the various units when grinding capacity work. The headstock and footstock are self-contained and may be moved to any desired point on the flat-topped table.

A new pictorial folder on the Norton Multipurpose Grinder will be sent on request — also a complete catalog. Write for one or both.

NORTON COMPANY
Worcester 6, Mass.

M 473-A

MAGNETIC HOLDING METHODS



THE BASIC UNIT

Super-holding power for milling gibs shown on left; flexibility for vertical or horizontal grinding set-ups on right.

New Holding Applications

Methods engineers in many war industries have applied the BODY FLO Magnetic Chucks to solve many tricky holding problems. Unusual work, large or small parts or pieces, are handled with ease. BODY FLO Magnetic Chucks also have abundant holding power.

The basic unit, in sizes to meet your requirements, is a precision instrument, and may be applied to surface grinders in the tool room or for production on your grinders, planers or shapers.

Several basic units, known as "Multiple Units", operated under one control may be used to hold many parts or pieces.

A recent application of "Multiple Units" in aircraft production on some very vital parts eliminated a battery of millers and sixty employees. BODY FLO Magnetic Chucks successfully held this unusual work on one grinder, increased production, reduced costs, eliminated a serious bottleneck.

Let us show you how BODY FLO Magnetic Chucks may solve your holding problem.

Send for "Magnetic Chucking Revolutionized"

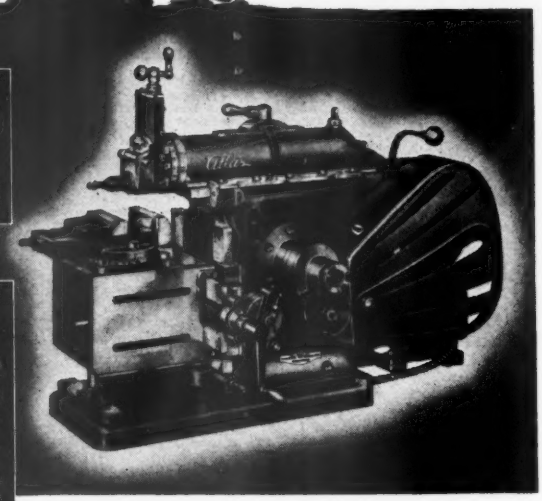
Planing set-up for gibs shown above; grinding set-up for small work shown below.

MAGNETIC HOLDING DEVICES, INC.

2034
EAST 22ND ST.
CLEVELAND 15,
OHIO

KEEP 'EM BLASTING BUY WAR BONDS

Atlas
7-INCH
SHAPER



CONDENSED SPECIFICATIONS
Ram Stroke ½" to 7"
Strokes per Minute 45, 78, 122, 200
Cutting Speeds ..... 3½ to 116 fpm
Table Travel, horizontal 9⅜"
Table Travel, vertical 4⅞"
Overall Dimensions 36"x17"x26" high
Crank-type bull-gear drive, complete V-belt drive, 5 automatic cross feeds.

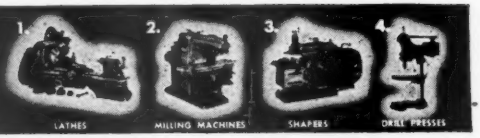
"MATCH THE MACHINE TO THE JOB"

The hopes of the free world are in the machine shops of America. To speed Victory, America's production goal of ships, tanks, planes and guns must be met!

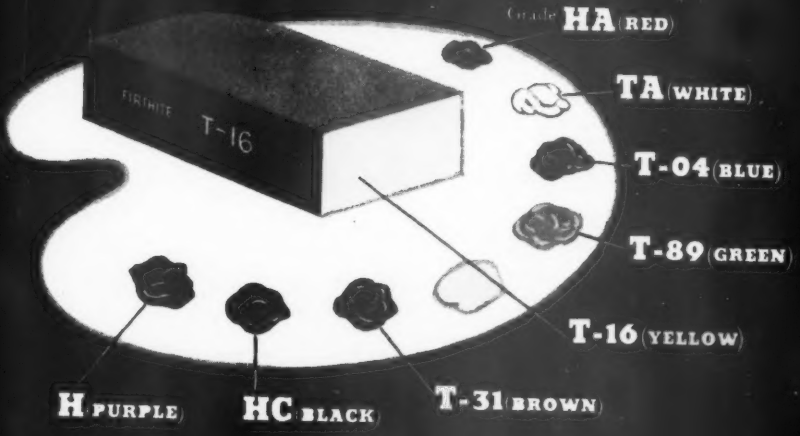
One sure way to reach that goal is to use machine tools to the limit of their capacities to make the most of every production hour. It means "match the machine to the job": massive machines where size and power are really needed — *modern, fast precision tools to take over small-parts production so that capacities of larger machines will not be wasted.*

Outstanding examples of compact modern machine tools are those in the Atlas 4 Tool Team for Small-Part Machining — Lathes, Milling Machines, Shapers, Drill Presses. Ask your Atlas supplier to give you the facts about their production capabilities or write us. Atlas Press Co., 1212 N. Pitcher Street, Kalamazoo, Michigan.

Atlas 4 TOOL TEAM FOR SMALL-PARTS MACHINING



Firthite "Color-Branding" GETS A BIG HAND FROM COAST TO COAST



COLORS, on Firthite Sintered-Carbide Tips, are proving a most popular means of telling one grade from another. The color scheme recently introduced by Firth-Sterling, as another service to Firthite users, sets a convenient standard for the industry. A Firthite Engineer will gladly explain how this color system can be used to advantage in your shop.

Send for COLOR CHART

Handy guide to selection of Firthite

Firth-Sterling Steel Company

This underside of a Catalin punch for producing cowl skins illustrates the manner and extent of coring to reduce weight and volume of resin required in making a cast.

Catalin stretch press dies for forming a fuselage part from fully hard "ST" Alclad have cut the production time for this operation from four hours to three minutes.

PLASTICS — FOR DEEP DRAWING AND STRETCHING ALUMINUM SHEETS

The adoption of Catalin Casting resins in the aviation field has been the result of close cooperation between our engineers and chemists and those of the Plastic Tooling department of the Curtiss-Wright Corporation.

Drill and saw jigs, router, shaper and hydro-form blocks, checking fixtures, stretch press molds and dies—particularly those involving contours—are now being quickly and inexpensively cast from several Catalin formulations, each developed for specific applications. These resins, supplied in liquid form, will enable you to cast tools in your own plant to a master part or plaster mold more quickly than those produced by forming, milling and handfitting, steel or wood. They have a high compressive strength, and are practically unaffected by fluctuating temperature or water absorption.

Punches cast from Catalin for deep drawing aluminum sheets are superior to metal. Their mirror-like surfaces eliminate uneven stretching, rupturing and wrinkling. They are better than lubricated wood punches, too, because they remain dimensionally stable even after prolonged storage. Shrinkage in service is only .00018 in. per in.

The expert services of Catalin's engineering staff are at your disposal. Should you be interested, you are cordially invited to write for complete details.

Cast Resins
Molding Compounds
Liquid Resins

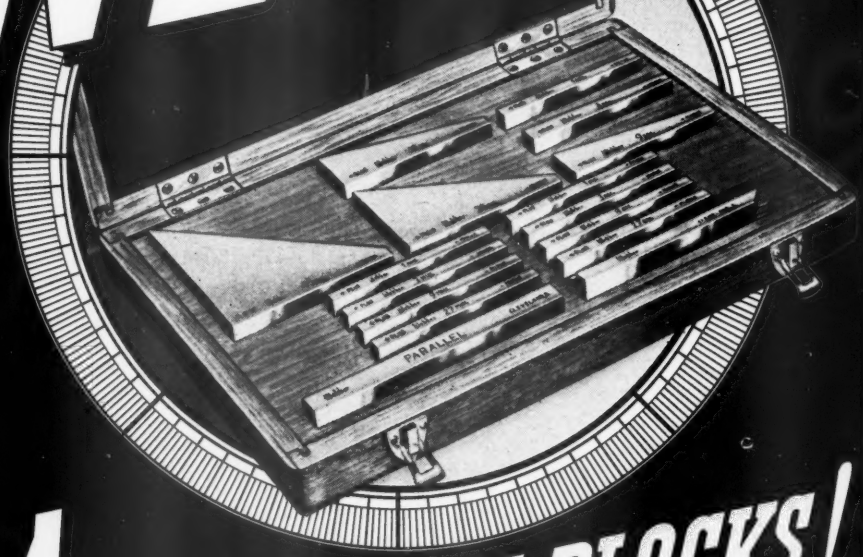
CATALIN
CORPORATION

ONE PARK AVENUE • NEW YORK, N. Y.

A Catalin punch which produces in two shifts what formerly required more than a week with previous methods. The parts shown are air scoops for the P40 Warhawk.

Large draw dies like this can be cast right in your own plant. When used for deep drawing the "orange peel" effect obtained with wood or metal punches is eliminated.

NEW!



ANGLE GAGE BLOCKS!

(FULLY PATENTED)

An absolutely NEW method for all precision angle measurement

Webber Gage Co.—largest manufacturer of gage blocks exclusively—proudly offers industry its latest achievement —WEBBER ANGLE GAGE BLOCKS. • Product of years of research and development, these blocks provide for the first time a simple, fast, sure means for precision measurement of angles—*at a cost within the reach of every shop.*

● A MILESTONE IN MEASURING ●

FACTS ABOUT
WEBBER ANGLE GAGE BLOCKS

SPECIFICATIONS

Furnished in sets of 14 blocks in 3 Series as follows:—
1st Series—Degrees—1—3—9—15—30—45
2nd Series—Minutes—1—3—9—27
3rd Series—Seconds—1—3—9—27

A complete set of WEBBER Angle Gage Blocks will yield any angle from 0° to 103° — a total of 370,800 angles — in steps of 1 second of an arc.

Working surfaces are optically flat — blocks wring together and adhere same as regular gage blocks.

Every set includes a parallel and knife edge.

HOW THEY ARE USED

Webber Angle Gage Blocks are used for precision measurement of angles in the laboratory, inspection room, shop, etc. To obtain a desired angle, blocks are selected from the set which when added — *or subtracted* — will yield that angle. These blocks are wrung together and will adhere just as with gage blocks.

Example: to obtain an angle of 12° — take the 3° and 9° blocks and wring them together with the large ends marked "plus" adjacent. Thus, 3° plus 9° equals 12°. To obtain an angle of 6° take the same two blocks (3° and 9°) but wring them together with the "minus" end of one adjacent to the "plus" end of the other. Thus, 9° minus 3° equals 6°.

Very little study is required to comprehend how 2 or more Angle Gage Blocks may be wrung together to produce any angle in degrees. The blocks in minutes and seconds are combined in the same manner and added on.

In the minute and second series only 4 blocks are needed which will combine to form up to 30 minutes. If 32 minutes is required — simply add to the original measurement one more *degree* (60 minutes). Then subtract 28 minutes from this — leaving 32 minutes which was required.

No mathematical computation is involved in using WEBBER Angle Gage Blocks. With each set is furnished a table showing which blocks to use and how to combine them to get any angle required. Precision angle measurement is reduced to an extremely simple, fast, sure operation.

If after long use or extremely hard wear they become damaged or inaccurate, they can be returned to WEBBER Gage Company, and restored to "like new" condition at a modest cost.

Absolute accuracy is assured since proof of the accuracy of the blocks is contained within the blocks themselves. This is true of gage blocks for linear measurement. Example — wring together any number of gage blocks to make a size equal to that of a single block. Then the group of blocks will check perfectly with the single block. By this principle — if the largest block in the set is correct then all the other blocks in combination checking with it must also be correct.

This principle applies in checking WEBBER Angle Gage Blocks inasmuch as the starting place is a straight line (instead of the largest block in the set as above) and a straight line can easily be checked by optical means.

WEBBER Angle Gage Blocks are guaranteed accurate to within $\frac{1}{5,184,000}$ part of a circle. Such accuracy, obviously, cannot be checked with the usual shop tools any more than regular gage blocks can be checked with a micrometer.

A limited number of sets of WEBBER Angle Gage Blocks are now available. Literature and prices furnished on request.

Webber
GAGE COMPANY

PRECISION GAGES produced by skilled craftsmen assuring the finest work to meet the most rigid specification. Our modern facilities are among the best. A complete, air-conditioned inspection laboratory enables us to build special tools and gages to your specifications, exactly. Our 24 years of experience can save you time and costly errors. Send blue prints for immediate quotation and delivery schedule.

JIGS AND FIXTURES are a specialty. Reasonably prompt deliveries can be made to firms with high priorities. Work up to 24" can be made with precision accuracy. Our experienced toolmakers with an Army-Navy "E" reputation can solve your tooling problem.

THREAD GRINDING facilities are available to manufacturers with war orders. Accurate machines and precision inspection equipment are used to assure highest quality work. Write or wire today for delivery dates.

ARMY E NAVY

TOOLS & GAGES, INC

3112 EAST 63RD STREET · CLEVELAND, OHIO

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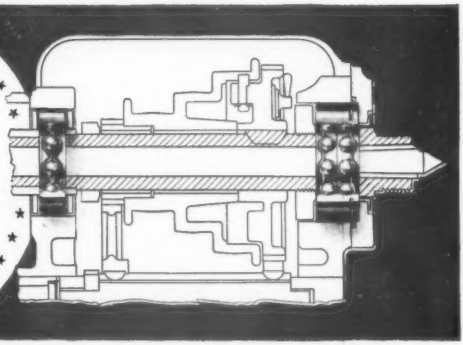

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The Tool & Die Journal is published monthly for those industry key men who are responsible for **designing, building** and **using** precision tooling.

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MORE ABOUT THOSE SURPLUS MACHINE TOOLS

SINCE the publication in November of our Plan for Orderly Disposal of Government Equipment, we have been the recipients of interesting questions and comments. These have ranged from the question of whether we are trying to "save" the Machine Tool Industry, to the conviction of a well-informed plant manager that every congressman and senator should be sent a copy of the plan, and its adoption vigorously promoted. Also, since originally setting up the plan, we ourselves have further comments and suggestions to make as the result of new facts and figures we have received.

Before discussing new details, let us answer the query about "saving" the Machine Tool Industry. We are quite convinced that the members of the Machine Tool Industry themselves are not thinking in terms of being "saved." They, like other American manufacturers, are well qualified to work out their own salvation, even though war production demands have thrown their industry far out of balance. The machine tool builder will be just as zealous in peace time as in war to provide American industry with machine tools which will maintain our industrial pre-eminence.

But the Nation as a whole should have a more-than-ordinary interest in the Machine Tool Industry. Its products along with those of expendable tool manufacturers and the Tool and Die Industry constitute the very foundation upon which all mass production is built. As a nation we need the uninterrupted development and improvement of our tooling and production equipment. Certainly the organizations which have developed tooling components for American production are best qualified to accomplish this.

Confusing, indeed, are such seemingly contradictory circumstances and statements made about them as that Industry must prove itself capable of maintaining a high rate of production and employment during the transition period when war contracts are being cancelled and peace-time goods cannot be manufactured in sufficient quantities to absorb discharged war plant employees because war materials are not available.

Added to this confusion is the fact that many plants which, converted to war, have quantities of machine tools and other production equipment which are not usable for peace goods production and whose ownership is in the Government. K. T. Keller, president of the Chrysler Corporation, recently stated that the Government owns more than 19,000 of the machine tools which are in Chrysler plants. Many of these cannot be used in automobile production, and those which can will have to be re-arranged before they can be effectively utilized.

One indisputable fact, however, is that productive plant capacity in the United States has been expanded far beyond what was thought possible. Fortunately a large proportion of the machine tools and equipment used in such expansions probably consists of standard types or at least such types as will lend themselves to reconversion. True, the enormous quantities of explosives, heavy guns, ships, and strictly war items will account for considerable of the new equipment, but the standard types definitely are in such quantities as to pose a problem. Now is the time to transfer every such machine tool that is no longer required in its present place to a new field of productivity.

In November we suggested a formula for determining the values of surplus machine tools and we suggested two methods of disposal: (a) In exchange for machine tools built prior to January 1, 1926; (b) For cash or on suitable credit terms. We are convinced that the elimination from American industrial inventories of *obsolete* machine tools and other equipment so exchanged would be a most invigorating action.

It has been estimated that before the war, 75% of the shops of the Nation were producing partially or entirely on machine tools and equipment more than 10 years old and on some much older. During the last three years, this condition has improved principally because the Army or the Navy has supplied war contractors with new machine or the Defense Plant Corporation has financed such installations directly for war plants. But there are still thousands of machine tools more than ten and even fifteen years old in our plants. Some of these are probably satisfactory for less exacting operations. But as a whole and comparatively, they are inefficient producing units. The benefits to be derived from substitution of modern machines would accrue to all of us by advancing our standards of production.

No doubt more specific and individual benefits would accrue to those tool shops and manufacturers who would exchange old machines for new but more efficient methods bring bigger profits and thus the United States Treasury would collect larger taxes.

The Machine Tool Industry also would be a *direct* beneficiary from having the Government pool of machines disposed of, but here again an industry could continue to be a substantial producing factor in our economic organization.

Since making our original proposal, we are convinced that two additional important "markets" for surplus equipment should be considered. From authoritative sources we have information that a majority of the schools and colleges of the country which have engineering and shop courses are seriously in need of modern tool-making and production equipment. The heads of one school, which is frequently referred to as possessing top-flight curricular qualifications, express it as their opinion that the school's equipment is so antiquated that it is actually unfair to the student who is enrolled in a shop course. Another authority states that tools in school shops are considerably poorer than similar equipment in most industrial plants. There are probably exceptions to this state of affairs, but it seems to be generally believed that most private engineering and technical educational institutions cannot boast of truly modern machine tools.

From a reliable source we learn that there are between three and four thousand high schools where the use of metal working equipment is taught. Some of these school shops are well equipped, particularly those situated in cities where manufacturers and business groups have cooperated to insure a better quality of trainee. In a few instances, machine tool builders themselves took an interest in the schools of their community and saw to it that equipment was modernized, although here again, we have a report that one such technical high school has asked repeatedly for a period of ten years for a well-known turret lathe to replace a very old one in the department. Public school funds were never available.

Technical and vocational schools of the Nation, both private and public, have never before been required to do such a job of training as the war has demanded. Many of them succeeded in spite of such severe handicaps as obsolete and inadequate equipment. Now it is likely that these schools will be called upon to do another important job of training during the re-conversion period because many of our young men, when they are mustered out, will wish to resume their educations. These boys will expect, and rightfully so, that their training will qualify them for prompt acceptance in our industrial plants and that it will enable them to compete successfully with those who remained at home to man the production battle-lines. This holds good also for the boys who today are only of high school age and whose training we hope will be to fit them for the manufacture of products for peaceful living and not of implements of war. That will require modern machine tools, expendable tools, and accessories. They should be the best obtainable.

Here we will anticipate the question of how the school should be permitted to acquire this equipment. It should be presented without charge to public and private schools without distinction because all are performing a service in the National interest. Allotments to individual schools should be made according to the requirements imposed by the courses which they teach and the industrial areas in which they are situated.

Again it should be emphasized that the value of this part of the plan will be enhanced by immediate preparation and fulfillment.

Lastly, but not less important, is a third outlet which has been suggested to us. It is no secret that our arsenals were for years, and our informant insists they still are, miserably equipped. There have been additions of new and modern machines but the opportunity for real modernization still exists in a big way. Here would seem to be the logical places for all armament and shell making machines and contributing components. Here also should be set up the newest standard equipment for experimental work, model and tool making and production of the military materiel which it may be decided we, as a nation, must maintain after the war.

Editor

AN OPTICAL PROFILE LATHE

Editorial Foreword

We are greatly indebted to the Bell Telephone Laboratories for the privilege of presenting this story of a unique development in the field of precision work control.

Unmistakable evidence of greatly increased interest in this country in applications of optics to metal working processes encourages the hope that our readers will find this account particularly timely and pertinent relative to problems of their own that could be solved in a like manner.

This Optical Profile Lathe was developed by the Bell Telephone Laboratories before the present war and was described in Vol. X, No. 1, of the "Bell Laboratories Record." The end result of this development is a combination machine tool and optical profile projector, or the combination of production and inspection facilities in one tool.

No great flight of the imagination is required to visualize the application of this technique to precision grinding in either repetitive manufacture or tool and gage work.

Recent developments in this country have proven, for instance, the practicability of grinding carbide form tools during projection. The operator manipulates the hand feeds in the usual manner but instead of watching the work, he watches the profile shadow on the projection screen. Thus, instead of stopping his machine in order to measure the work in position, by micrometer, caliper or template, or to remove the work from the machine to a profile projector, the operator, in effect, simply "grinds the shadow on the screen" until it coincides with the master outline on the ground glass. The resultant reduction in comparative time for grinding intricate tool profiles is far greater than fifty percent!

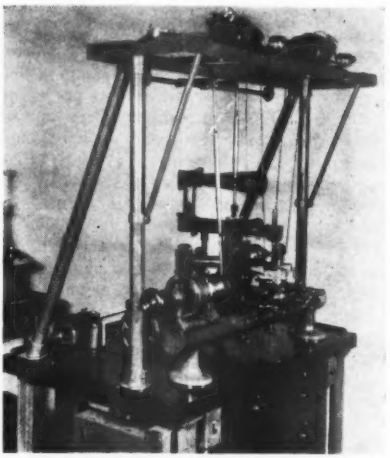
The employment of optical aids in metal working has been far more commonplace in Europe than in this country. This is best evidenced by the extensiveness of the patent art of foreign origin. Next month we plan to list and explain some of the more outstanding foreign methods and machines.

E. W. P., Tech. Ed.

HOW far an engineering art has progressed may perhaps be indicated by the degree of refinement which the art feels it can demand in its products. This is well shown by the advanced arts of telephony and its allies, which require extreme precision in most of their apparatus. Such precision is based in almost all cases on exact mechanical dimensions.

But the degree of mechanical precision which is adequate in many arts is not always adequate in the arts of communication. Elsewhere exactness is required principally to insure mechanical fitting and interchangeability of parts, and need not exceed what can be secured by mechanical gaging. Communication apparatus, on the other hand, is employed to produce effects which are judged by the subtle senses of hearing and sight. Defects of equipment which are mechanically imperceptible may seem disastrously large to ear and eye.

As a result of this critical nature of the dimensions of telephone apparatus, the Bell Telephone Laboratories Development Shop, the organization in which the creations of these Laboratories first take physical form, is today required to make the most diverse experimental models accurate to specification. Often these models involve very small parts, of irregular profile, in which every length, angle, and radius of curvature must be correct. These parts may be as soft as rubber or as hard as diamond. Instrument pivotal systems, phonograph recording styluses and reproducing needles, light-valve parts, optical slits, and quartz crystals for frequency control are examples of such parts and indicate their diversity.



Photo, courtesy Bell Telephone Laboratories

Fig. 1 — The optical profile lathe consists of a standard precision bench lathe, revised and rearranged for extreme mechanical versatility, to which has been added an optical projection system.

All require workmanship of the highest order performed under the microscope.

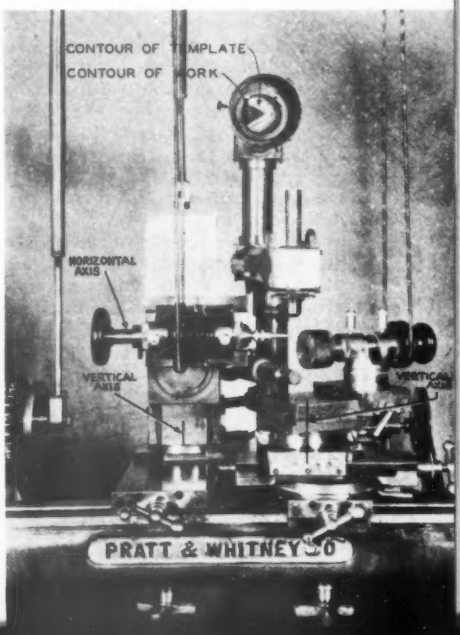
It is, of course, impossible to design and install in the precision room special machinery to manufacture each of these parts on an experimental basis. The shop must aim to make one tool serve many purposes. Accordingly there has been designed and installed in the room a lathe of unusual flexibility, adapted for development purposes to many specialized machining operations.

The familiar lathe of the ordinary machine shop consists essentially of a rigid cast iron bed on which a power driven spindle is mounted in a "headstock" at one end, and a "tailstock" is mounted at the other. Materials to be turned are either "chucked" on the headstock or pivoted on centers between the headstock and the tailstock, and are machined by tools held in a movable carriage on the bed. The special lathe in the precision room, shown in Fig. 1, carries no tailstock, since the materials to be machined on it are so short that they can be firmly chucked on headstock alone. Instead it has two additional headstocks whose spindles can be independently and simultaneously driven by motors of variable speed. The first or "main" headstock is only occasionally used as a headstock; ordinarily its use is confined to producing a reciprocating motion to drive certain of the various sliding carriages supporting the other two headstocks. Both these latter are suited for chucking either work or tools; and their carriages can be adjusted and moved in the most varied ways, by hand or by drives from the main headstock.

The motor at the rear of the bench drives a slow-speed "jack shaft" which furnishes power through sprockets and chain to the main headstock. From this head, by means of a crank pin, a connecting rod, a rocking shaft, and a second connecting rod, a reciprocating movement is given to the vertical slide on which the second headstock is mounted. The spindle of this head is driven through an elastic belt by a motor mounted on the superstructure. From Fig. 2, it can be seen that the second head can be set at various angular positions about the horizontal axis of its mounting to the vertical slide, and about the vertical axis of this slide's mounting to the compound slide on the lathe bed. By screw feeds in the compound slide, the head can be moved in the plane of

Fig. 2 — The two auxiliary headstocks permit a great variety of movements and functions.

Photo, courtesy Bell Telephone Laboratories



the bed. When continuous rotation of the work or tool is not desired, the headstock can be replaced by a vise or an indexing milling fixture.

The third headstock, whose spindle is driven by a belt from another motor on the superstructure, is mounted on a screw-adjusting slide which in turn is pivoted about a vertical axis to a compound slide clamped to the lathe bed. This head can be given a continuous oscillating movement about the vertical axis by a drive (Fig. 3) from the jackshaft through a belt, a worm and wheel, a crank with adjustable crankpin, and a connecting rod. By the upper slide, the radius of rotation of the head about the axis can be adjusted; and by the compound slide the head can be fed either across or along the lathe bed. A stationary tool holder can be substituted for the third head, as for the second head.

Machining operations of all types are performed on this lathe. The variable speed of the driving motors enables free use of tools for turning, milling, sawing, drilling, grinding, lapping and polishing. When brittle materials such as diamond, sapphire, quartz or glass are being machined, a special adapter is interposed between the third headstock and its slide, to limit the pressure of the cut by providing a yielding cushion between work and tools.

Since it is always difficult to ensure concentricity in rechucking refined work, the possibility of forming a complicated part on this lathe at a single chucking is one of the most valuable results of its versatility. Thus every surface and clearance angle of a recording stylus (Fig. 4) can be formed with great accuracy by the successive use of appropriate tools with suitable adjustments and motions of the lathe.

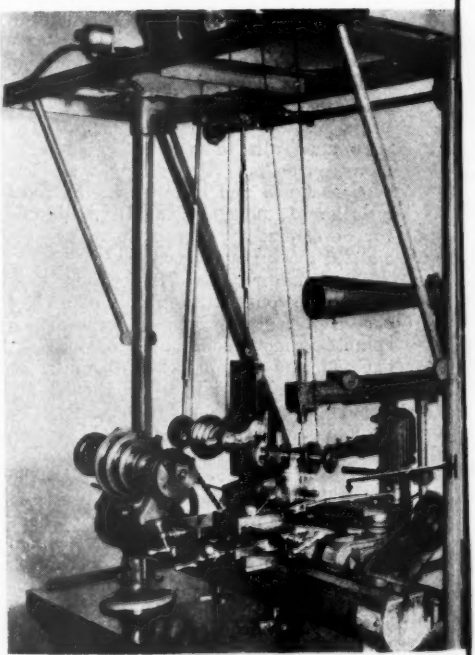
By chucking a piece of work in the second head and a tool in the third, and oscillating the latter on its pivot, a spherical surface can be generated, of radius equal to the distance of the tool from the pivoting axis. Then, combining the oscillation of the third head with the vertical reciprocation of the second, the surface can be lapped and polished. It is in this way that the spherical points of the playback needles, a thousandth of an inch in radius, are machined.

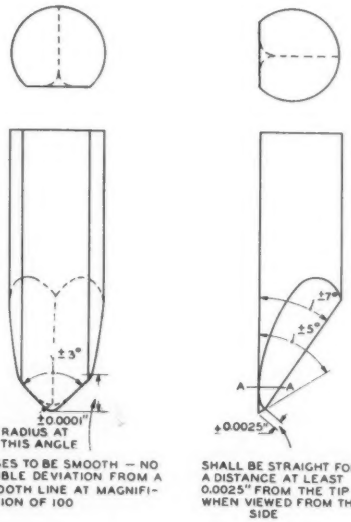
Since most of the work for this lathe is too small to measure accurately by the usual methods without being removed from the machine, the measurements are made on the spot by an optical projector (Fig. 5). This instrument, when moved over the work, projects a magnified image of the work on a ground glass screen, on which is also marked an enlarged drawing of the work. Magnification and scale of drawing are usually fifty to one. Inasmuch as highly corrected lenses and prisms are used in the projector, matching the projected image of the work with the drawing ensures a satisfactory measurement of profile and dimensions.

To assist in setting up the work, measuring deviations from concentricity, and

Fig. 3 — The driving link or crank H provides an oscillation of the third headstock, the amount of which is variable by T-slot adjustment of the crank throw. The resultant of these motions permits the generation of spherical surfaces on work held in the third headstock.

Photo, courtesy Bell Telephone Laboratories




±3°
±0.0001"
RADIUS AT THIS ANGLE
EDGES TO BE SMOOTH — NO VISIBLE DEVIATION FROM A SMOOTH LINE AT MAGNIFICATION OF 100
±7°
±5°
A
A
±0.0025"
SHALL BE STRAIGHT FOR A DISTANCE AT LEAST 0.0025" FROM THE TIP WHEN VIEWED FROM THE SIDE

Courtesy Bell Telephone Laboratories

Fig. 4 — The versatility of the optical profile lathe makes possible the accurate shaping of an entire sapphire stylus at a single chucking.

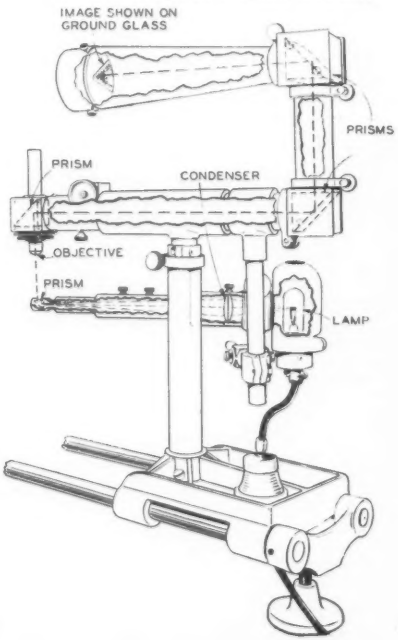
examining the character of finished surfaces, a microscope is often used. Not shown in the illustrations, it is mounted on a pedestal arm carried on the lathe bed in the position occupied on the standard lathe by the tailstock, and can be moved over the work in the same way as the projector.

This complicated series of slides and spindles, motions and microscopes, would fail of its intended purpose if it suffered from measurable mechanical imperfections. Great care must be taken to eliminate vibrations due to unbalance of rotating parts, joints in the belts, and the like. There must be no end or radial play between the headstocks and their spindles; the slides must be free from side play, and must move in perfectly straight paths. Omitting the utmost precautions would leave far too great a ratio of the play to the size of cut for satisfactorily precise results.

In producing any one part the lathe cannot, of course, compete with machines designed to produce that part to standardized dimensions on a manufacturing basis. Its use is as an adjunct to development, where continual experimental change is the rule. In the hands of the skilled mechanicians of the precision room, it will play a large part in the pioneering work of these Laboratories toward an ever more exact telephone art.

Fig. 5 — The profile projector provides a means of measuring the work accurately without removing it from the lathe. Its optical system is made up of the light source (lamp), condenser lens, small 45° prism, objective lens, three large 45° prisms, and image screen (ground glass). The mechanical structure of the profile projector is slideably mounted on the two horizontal rods. When traversed forward toward the operator, that portion of the light beam, or optical axis, between the small 45° prism and the objective lens is intercepted by the periphery of the chucked work. Thus the profile of the work is projected, at a predetermined magnification, upon the image screen where it is compared with a master contour. This is best seen in Figure 2.

Courtesy Bell Telephone Laboratories



PRECISION CONTROL

John A. Harrington

PRESIDENT

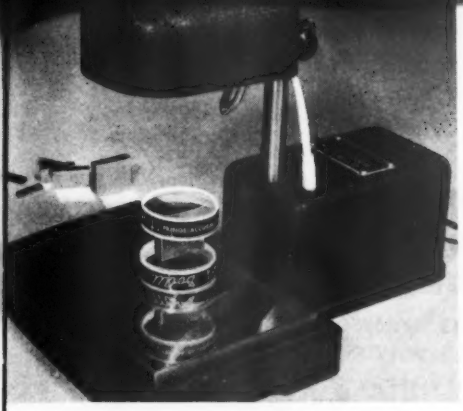
Savage Tool Company

PRECISION control, the foundation for quality control, has come into universal use and is firmly established in the mass production of war articles. The methods which have been developed and the precision instruments used are accepted standards and will become even more important to the interchangeable parts manufacture of subsequent peacetime production. The basic requirement necessary for the production of duplicate parts is a standard of measurement. A physical standard has to be available to each producer no matter where he may be located.

The new DoAll Vernier Gage Block. This clever innovation consists of an opposed pair of wedge-shaped gage blocks acting as an "adjustable parallel" and having a nominal size or "zero setting" of .700". Longitudinally displacing the upper block in relation to the lower varies the size of the parallel in increments of .000010". As calibrated, the "parallel" can be varied from .006950" to .007050", a range of .0001". The measurement over the pair illustrated is .007010". In addition to being used for "building" dimensions to fractions of "tenths", this Vernier Block can be set to compensate for the measured wear of standard blocks.

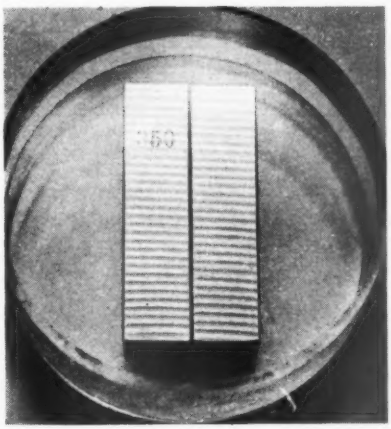
An "Inspection Laboratory", both compact and portable, consisting of gage blocks, holders, measuring jaws, height gage base, parallels, master square, surface plate, vernier gage block, optical flats and monochromatic light, rust preventive and solvent.

Precision gage blocks fulfill all of these requirements when they are produced by a reputable manufacturer with the proper equipment and experienced personnel. Many of the phases of production of gage blocks combine a skill



Monochromatic light source and optical flats arranged for inspection of a gage block as to surface flatness and wear.

with an art and require the services of highly trained and experienced workmen. The need for this high degree of skill is readily recognized when watching an operator use an optical flat to check, for instance, the flatness of a block. In this operation alone a great deal of experience is necessary to know how to bring out the interference bands under monochromatic light and how to interpret these bands in units of millionths of an inch. This operation is only one of dozens performed on each block, all of which require skill and training.



Appearance, by monochromatic light illumination, of two gage blocks being compared as to size and parallelism under an optical flat.

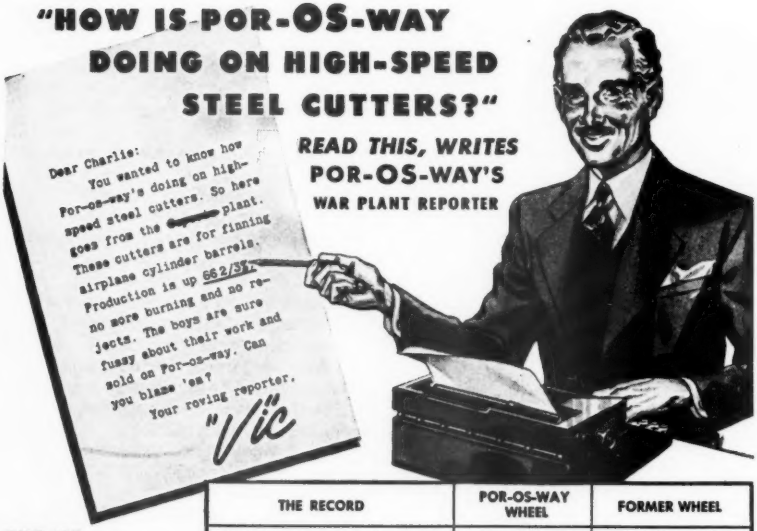
Each of these blocks is an exact duplicate of the standard unit of measure which is internationally accepted. Thus, a manufacturer has at all times, at standard temperature, exactly the same "standard inch", and fractions thereof, which every other manufacturer uses and he is therefore able to produce an exact duplicate part at any time from the specified dimensions for that part. In the past he was able to produce duplicate parts within his own plant because he used one, previously made as a master, with which to check subsequent pieces, but he could not produce a duplicate part from a drawing alone. Now, since he knows that his inch is standard, he builds up a stack of gage blocks to the dimension called for on the drawing and from this he produces an exact duplicate even though he has never made that particular part before.

The need for these precision instruments in mass manufacture is generally recognized but quite frequently we fail to see that the production of smaller quantities makes their use even more necessary. We might cite, as an ex-

(TO PAGE 116—PLEASE)

A gage block-sine chuck set-up for checking a profile gage. Passing the set-up under a dial indicator will show any significant profile angle error.

"HOW IS POR-OS-WAY DOING ON HIGH-SPEED STEEL CUTTERS?"


Dear Charlie:
You wanted to know how Por-os-way's doing on high-speed steel cutters. So here goes from the [redacted] plant. These cutters are for finning airplane cylinder barrels. Production is up 662/3%. no more burning and no rejects. The boys are sure fussy about their work and sold on Por-os-way. Can you blame 'em?
Your roving reporter.
"Vic"

READ THIS, WRITES POR-OS-WAY'S WAR PLANT REPORTER

THE RECORD	POR-OS-WAY WHEEL	FORMER WHEEL
Production per man per hour	5 sets (20 pcs.)	3 sets (12 pcs.)
Pieces per dressing	8 to 12	3
Wheel life	8 hours	6 hours
Stock to be removed	.010"—.018"	Same
Depth of cut per pass	.003"	.001"
Rejects	None	0.5 to 1%
Operations eliminated	Cutting shoulder	
Production Increase	66⅔%	
Remarks: Former wheel burned work. Por-os-way grinds cool, holds corner.		

THE JOB: Grinding sets of Huther high-speed steel cutters for finning airplane cylinder barrels on a universal tool and cutter grinder.

THE WHEEL: Por-os-way 7" x ½" x 1¼" 9A60HV2.

All facts and figures given are taken from an actual field survey.

WRITE, for complete booklet "Facts About Por-os-way". The address is 464 Wheatland Street, Phoenixville, Pa.

2 TO 5 TIMES MORE WAR PRODUCTION PER MAN PER MACHINE

POR-OS-WAY* a new RADIAC* PRODUCT

A. P. DE SANNO & SON, INC.
NEW YORK, CHICAGO, PITTSBURGH, CLEVELAND, DETROIT, LOS ANGELES

PHOENIXVILLE, PENNA.
Western Gateway to VALLEY FORGE

*T. M. Reg. U. S. Pat. Off.
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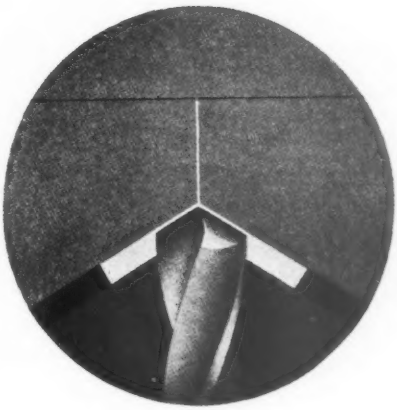
for Victory

DRILLING TECHNIQUE

There is nothing more essential to the success of drilling operations than correctly ground drills.

The design and cutting action of a drill are such that for any given hole diameter and material the so-called correct drilling speed and feed are optimum or compromise values.



This prescribes proper drill grinding equipment because no "free-hand" grinding of drill points can insure the all-important symmetry of relief, included angle and center location.

At the drill center the cutting action is zero, increasing to maximum effectiveness at the periphery of the cutting lips.

This variable being a necessary evil, every precaution must be taken that the shape of the drill point will be as nearly perfect as possible.

These illustrations are of symmetrically ground drill points as viewed for inspection with optical drill point gages.

This is Part II of DRILLING TECHNIQUE, Training for Victory series. The two parts are now available as a complete 16-page reprint, revised and augmented.—Editor.

Indication of Too Much Feed

If a drill *chips out* at the cutting edge, it is a sure indication of too heavy a feed or too much lip clearance. A drill which splits up the web is also evidence of too much feed for the amount of lip clearance—or both. Too much lip clearance at the center or at any point on the lip will cause the cutting lips to chip.

Indication of Too Much Speed

High speeds in cast iron tend to wear away the margin. When the extreme outer corners of the cutting edges wear away too rapidly, it is evidence of too much speed.

In general, a high speed and light feed is recommended. It is better to err on the side of too much speed than too much feed except for cast iron where the nature of the material permits an unusually heavy feed. The speed can be increased to the point where the outside corners commence to show signs of wearing away. It can then be slightly reduced and maintained at this speed.

Lubrication

Lubricants have many functions, several of which are as follows:

(a) To cool both the cutting edges of the tool and the work being machined. This can be done by directing as large a volume of the coolant as possible on the cutting edges. On thin walled work it often helps to allow a large column to flow onto and around the piece.

(b) To lubricate the chips. This aids in chip clearance.

(c) To force the chips back from the cutting edges and out the flutes of oil feeding drills. High oil pressure will accomplish this most efficiently.

(d) To improve the finish of the work. The selection and proper application of the lubricant will materially influence the machined finish.

Lubrication problems should be referred to a reputable manufacturer of cutting oils. The following list of lubricants are only suggestions:

Aluminum and its alloys: Soluble oil, kerosene and lard oil compounds, light viscous neutral oil, kerosene and soluble oil mixtures.

SUGGESTED SPEEDS FOR HIGH SPEED DRILLS

	Speed in FPM
Aluminum and Its Alloys	200-300
Bakelite	100-150
Brass and Bronze, Ordinary	200-300
Bronze, High Tensile	70-100
Cast Iron, Soft	100-150
Cast Iron, Hard	70-100
Cast Iron, Chilled	30-40
Malleable Iron	80-90
Magnesium and Its Alloys	250-400
Monel Metal	40-50
Steel Machinery .2 to .3C	80-110
Steel, Annealed .4 to .5C	60-70
Steel, Tool, 1.2C	50-60
Steel Forgings	50-60
Steel, Alloy	50-70
Steel, Stainless, Free Machining	60-70
Steel, Stainless, Hard	30-40
Slate, Marble and Stone	15-25
Wood	300-400

Carbon steel drills should be run at speeds of from 40 to 50% of those given above.

Brass: Dry, soluble oil, kerosene and lard oil compounds, light non-viscous neutral oil.

Copper: Soluble oil, winter strained lard oil, Oleic acid compounds.

Cast Iron: Dry or with a jet of compressed air for a cooling medium.

Malleable Iron: Soluble oil, non-viscous neutral oil.

Monel Metal: Soluble oil, sulfurized mineral oil.

Steel, ordinary: Soluble oil, sulfurized oil, high E.P. Value mineral oil.

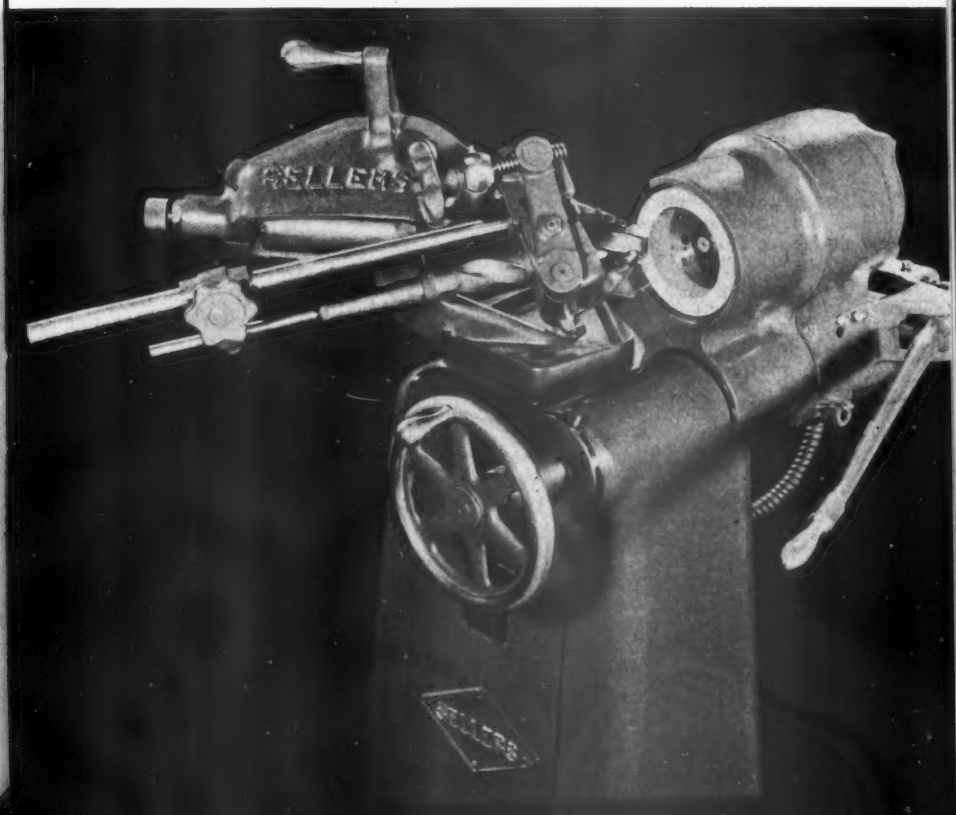
Steel, very hard and refractory: Soluble oil, sulfurized oil, turpentine.

Drilling Hard Materials

Very often, even after grinding a drill properly and increasing the speed to the extreme limit, the drill still fails to penetrate. This is usually caused by a hard spot in the material itself. It can be remedied or at least helped by liberal application of turpentine directly to the work.

Another method is to reduce the entering angle of the lips usually called the "rake angle", so as to permit the use of a heavy feed pressure. If a heavy feed pressure were used without first grinding the sharp angles off the lips (called "raking") as in Fig. 14, the drill would

Fig. 13 — A typical drill grinder. Attachments are also available that can be used on any standard grinder.



chip on the lips. This removal of the sharp angle on the lips must be done with extreme care and judgment, or the drill will have to be reground throughout. A good rule to follow is "the harder the metal the lighter the feed and slower the speed."

Drilling Small Holes

In drilling holes of small diameter, unless the feed and speed are given unusually careful attention, the danger of breakage is very great, especially at the moment the point of the drill breaks through the other side of the work. When using a hand feed the danger of breakage is greatest since it is difficult to regulate the degree of pressure exactly. When drilling with small drills it is better to use too much speed than not enough, and to keep the feed light.

Drilling Brass

Owing to the softness of this material, a heavier feed than for the harder materials may be used, especially in automatic machines, in order to insure the chips having sufficient body to follow the flutes out of the hole. The form of point illustrated in Fig. 14 is also efficient for drilling soft materials such as brass or any material where the normal point has a tendency to *hog in* or *grab*.

Drilling on Automatics

When drilling holes on automatics where they do not exceed four drill-di-

Fig. 14 — A specially ground drill for hard materials.

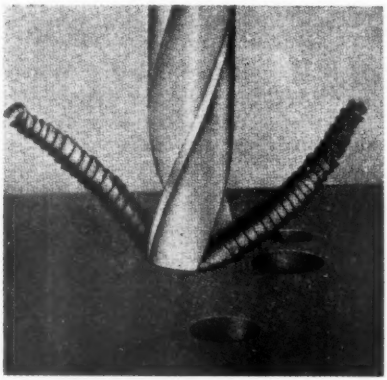


Fig. 15—An illustration of a properly rolled chip. Note how compactly these chips fit into each other.

Fig. 16—One method used to thin a web. A round faced emery wheel is used.

Fig. 17—This method of web thinning is known as notched point thinning and is done with a sharp cornered emery wheel.

ameters in depth it is recommended that a high speed and light feed be used with a large volume of coolant. Always endeavor in automatic drilling to get a small, compactly rolled chip (Fig. 15) and if possible keep it unbroken the entire depth of the hole, as such a chip feeds out through the flutes most easily.

Web Thinning

Due to the gradual increase in the thickness of the web as a drill is pointed back, it is necessary to thin the web at the point to obtain maximum results. This operation may be done in several ways. Figure 16 illustrates the method commonly used. In this case the thinning is done with a round-faced emery wheel. Figure 17 illustrates what is known as the *notched point* thinning and is done with a sharp cornered hard emery wheel. This type of thinning is especially adapted for hand feed such as turret lathe, screw machine and similar work. Correct web thinning is just as important as point grinding in securing satisfactory performance from a drill.

Common Errors and Their Correction

Broken Tangs

Broken tangs result from a variety of causes—they may be traced to the use of badly mutilated sockets, to the use of drills whose shanks are so "banged up" that they do not fit snugly into the socket, or to the use of drills with badly mutilated tangs. Although the tang of the drill is designed to carry a portion of the driving strain, the tapered fit between the shank of the drill and the wall of the socket should carry a large share of this strain. As a result, if either the inner wall of the socket or the surface of the shank is mutilated, a perfect fit is impossible. Under such conditions the whole driving strain is thrown on the tang. Often the tang breaks, through no fault of its own, but rather through faulty treatment of either the drill or the socket. Before inserting a drill rub off the shank to make certain it is smooth and free from grit. Also inspect the inside of the socket to be sure it is in the same condition.

Proper "Drift-Out"

In drifting a drill out of a socket never use anything but a drift. The use of such makeshifts as files or wedges is likely to permanently injure either the drill or socket or both. In removing the drill from the spindle or socket, take great care that the point or tip does not hit the table of the press or the work. It is well to have a bit of wood handy onto which the drill can drop as you drift it out.

Proper Inserting

In inserting a drill into the socket, never use a machinist's hammer, as this dulls the tip of the drill and nicks the cutting edges. Always use a material considerably softer than the drill itself —such as a lead or rawhide hammer.

Machine Rigidity

One of the most common causes of drill breakage is lack of rigidity in the press or in the work. Drill presses which are too weak to resist the feed pressure without springing, due either to faulty design of the table or of the feeding parts, and drill presses having lost motion in the spindle, invite breakage because the sudden release of the resistance to the feed pressure when the point breaks through the far side of the work causes the lips to bite too deeply into the work. This causes the lips to catch and sufficient strain results to break the drill.

Work Rigidity

The same results come about from faulty setting up of the work. Underneath the drill the work should be absolutely rigid and free from spring. The work should never be held in the hand. It should be rigidly clamped to the table of the press. In production work the use of properly designed drill jigs is important. A 24-page booklet covering modern designs for drill jigs is available through The TOOL & DIE Journal.

DRILL TROUBLE

EFFECT	CORRECTION
Drill breaks.	Check work and table for rigidity. Increase speed or decrease speed; both are causes for drill breakage. Dullness of the drill or too little lip clearance will result in breakage.
Outer corners of cutting edges break down.	Decrease speed. This is almost always the result of too high a speed. It can also be caused by insufficient or the wrong lubricant.
Lips or cutting edges break down.	Decrease the feed pressure. This may be a sign of too much lip clearance for the material being drilled.
Chipping or checking of high speed drills.	This is caused by too much feed or by rapid heating and cooling of the drill when working or grinding. It is corrected by either reducing the feed pressure or by an increased volume of coolant. Never plunge a drill in cold water when grinding it. This will always cause checking.
Drill requires more feed pressure than normally.	Caused by increase in thickness of the web. A web-thinning operation is necessary.
Only one lip is performing a cutting operation.	This results from unequal angles or lengths of the cutting lips. The drill must be reground properly.
The hole drills out too large.	Check the angle of the drill or length of the cutting edges. If the angles of the two lips vary or if their lengths are different, a larger hole than desired always results. If both the angles and lengths are correct, check for wear in the jig bushing or machine spindle.
Drill splits up the center.	Results from too great a feed. Reduce the feed first. Also check the lip clearance since too little clearance will result in splitting.
Finished hole has rough surface.	A number of things can cause hole roughness. For precision work it is important to check each of the following points: use a sharp drill only; be sure it is ground properly; use the correct lubricant with a sufficient volume; be sure the setup is the best possible for the necessary accuracy and quantity of pieces to be drilled. All of these items can be correct but if too great a feed is used the hole will be rough. It is best to use a high speed and a slow feed.

CHECK CHART

EFFECT	CORRECTION
Drill breaks when coming through the work.	Test the press and work for rigidity and alignment. The breaking is caused by the spring or backlash in the press or work.
Outer corner of cutting edges break when drilling hard material.	A turpentine lubricant will frequently help this condition. It is also wise to reduce the spindle speed.
The drill breaks when drilling brass, wood or other soft materials.	This is caused by chips clogging up the flutes. It can be corrected by using a properly designed drill for soft materials and increasing the speed.
Drill grabs in the work.	Check machine spindles and bearings.
Drill tang breaks.	This is usually caused by nicks, dirt or burs on the taper shank or a worn-out socket. By reaming the old socket or using a new one and by being sure the taper shank fits perfectly, the danger of tang breakage may be eliminated.
Chipping of margin.	An oversized jig bushing will cause chipping so select the proper size drill jig bushing.
A sharp drill will not cut.	Allow sufficient clearance back of the cutting edges.
Drill wears rapidly.	Increase the volume of coolant since this is an indication of a lack of lubrication. May be necessary to increase the body clearance to allow the lubricant to reach the point.
When drilling certain materials, drill lacks cutting efficiency.	Most drills are furnished with a 59° point. But when drilling harder than usual materials the angle should be increased. For example, a point-angle of 75° is recommended for manganese steel, while for wood and fibre a 30° point-angle is best.
Cutting edges become either convex or concave.	If the point-angle is changed appreciably, it may be necessary to grind the flutes of the drill in order to produce straight cutting edges.
Drill point is weak.	Caused by too little web. As a general rule, a web thickness at the point of approximately 12½% (⅛) of the drill diameter is recommended.

EQUIVALENT DRILL SIZES

Fraction No. and Letter	Decimal	Metric
7/32	.2187	
	.2205	*5.6*
2	.2210	
	.2244	*5.7*
	.2264	*5.75*
1	.2280	
	.2283	*5.8*
	.2323	*5.9*
A	.2340	
15/64	.2344	
	.2362	*6.0*
B	.2380	
	.2402	*6.1*
C	.2420	
	.2441	*6.2*
D	.2460	
	.2461	*6.25*
	.2480	*6.3*
1/4	.2500	
E	.2500	
	.2520	*6.4*
	.2559	*6.5*
F	.2570	
	.2598	*6.6*
G	.2610	
	.2638	*6.7*
16/64	.2656	
	.2657	*6.75*
H	.2660	
	.2677	*6.8*
	.2717	*6.9*
I	.2720	
	.2756	*7.0*
J	.2770	
	.2795	*7.1*
K	.2810	
9/32	.2812	
	.2835	*7.2*
	.2854	*7.25*
	.2874	*7.3*
L	.2900	
	.2913	*7.4*
M	.2950	
	.2953	*7.5*
19/64	.2969	
	.2992	*7.6*
N	.3020	
	.3031	*7.7*
	.3051	*7.75*
	.3071	*7.8*
	.3110	*7.9*
5/16	.3125	
	.3150	*8.0*
O	.3160	
	.3189	*8.1*

Fraction No. and Letter	Decimal	Metric
	.3228	*8.2*
P	.3230	
	.3248	*8.25*
	.3268	*8.3*
21/64	.3281	
	.3307	*8.4*
Q	.3320	
	.3346	*8.5*
	.3386	*8.6*
R	.3390	
	.3425	*8.7*
11/32	.3437	
	.3445	*8.75*
	.3465	*8.8*
S	.3480	
	.3504	*8.9*
	.3543	*9.0*
T	.3580	
	.3583	*9.1*
23/64	.3594	
	.3622	*9.2*
	.3642	*9.25*
	.3661	*9.3*
U	.3680	
	.3701	*9.4*
	.3740	*9.5*
3/8	.3750	
V	.3770	
	.3780	*9.6*
	.3819	*9.7*
	.3839	*9.75*
	.3858	*9.8*
W	.3860	
	.3898	*9.9*
25/64	.3906	
	.3937	*10.0*
X	.3970	
Y	.4040	
13/32	.4062	
Z	.4130	
	.4134	*10.5*
27/64	.4219	
	.4331	*11.0*
7/16	.4375	
	.4527	*11.5*
29/64	.4531	
15/32	.4687	
	.4724	*12.0*
31/64	.4844	
	.4921	*12.5*
1/2	.5000	
	.5118	*13.0*
33/64	.5156	
17/32	.5312	
	.5315	*13.5*

Fraction No. and Letter	Decimal	Metric
35/64	.5469	
	.5512	*14.0*
9/16	.5625	
	.5709	*14.5*
37/64	.5781	
	.5905	*15.0*
19/32	.5937	
39/64	.6094	
	.6102	*15.5*
5/8	.6250	
	.6299	*16.0*
41/64	.6406	
	.6496	*16.5*
21/32	.6562	
	.6693	*17.0*
43/64	.6719	
11/16	.6875	
	.6890	*17.5*
45/64	.7031	
	.7087	*18.0*
23/32	.7187	
	.7283	*18.5*
47/64	.7344	
	.7480	*19.0*
3/4	.7500	
49/64	.7656	
	.7677	*19.5*
25/32	.7812	
	.7874	*20.0*
51/64	.7969	
	.8071	*20.5*
13/16	.8125	
	.8268	*21.0*
53/64	.8281	
27/32	.8437	
	.8464	*21.5*
55/64	.8594	
	.8661	*22.0*
7/8	.8750	
	.8858	*22.5*
57/64	.8906	
	.9055	*23.0*
29/32	.9062	
59/64	.9219	
	.9252	*23.5*
15/16	.9375	
	.9449	*24.0*
61/64	.9531	
	.9646	*24.5*
31/32	.9687	
	.9842	*25.0*
63/64	.9844	
1.	1.0000	

We are indebted to the Cleveland Twist Drill Co., Republic Steel Corp., Chicago-Latrobe Twist Drill Works, Whitman and Barnes Co., Sellers Co., Mead Specialties Co., Delta Mfg. Co., Acme Industrial Co., Bausch & Lomb Optical Co., and others who provided illustrations and textual data.

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• The following articles, prepared in booklet form, contain valuable information and instruction to help the designer, builder, tool room man and production man progress in his respective field.

Let them help you with your problem. Simply check the items you need, enclose remittance and send to American Industrial Publishers, 320 Fairmount-Cedar Bldg., Cleveland 6, Ohio.

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BROACHING TECHNIQUE—An article containing information on broach design, types of broaches, internal and external broaching, proper broach handling, and broach sharpening. Part two covers the design of broaching machines—vertical, horizontal, pull, push, etc. Sixteen pages in all. Price 20c

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JIG DESIGNING PRECAUTIONS

C. W. Hinman
Designing Engineer

IN Fig. 128, the drilled work is seen at *A* together with the jig for drilling it. The work is a brass plate machined closely to gage sizes. There are four holes drilled through this piece as shown in the sketch. The three side holes are six times deeper than the drill diameters and, in order to drill straight holes, each one must be drilled half way through the piece from each side of the jig.

The jig body is a channel type and is milled from a solid block of machinery steel. Large jig bodies require a wood pattern and are cast from semisteel. Some large jigs are built up by arc welding the separate parts together. When channel jig bodies are machined from solid blocks, if the depth is more than

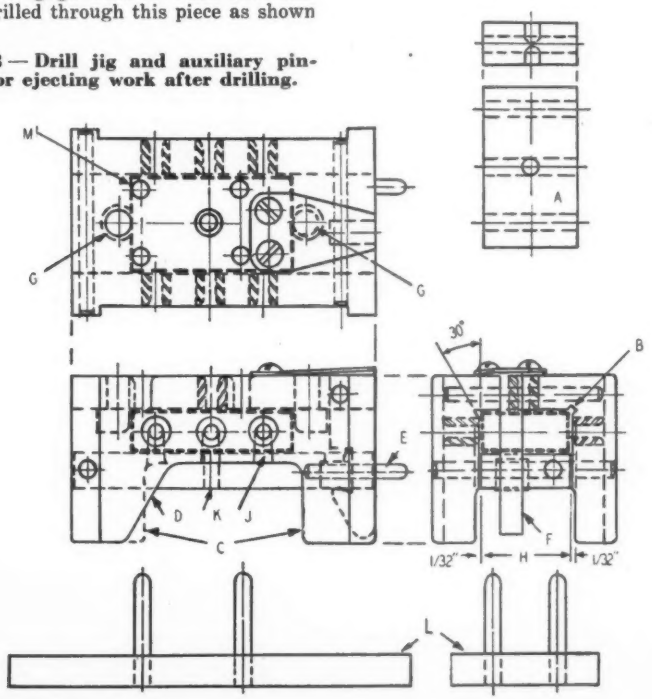


Fig. 128 — Drill jig and auxiliary pin-plate for ejecting work after drilling.

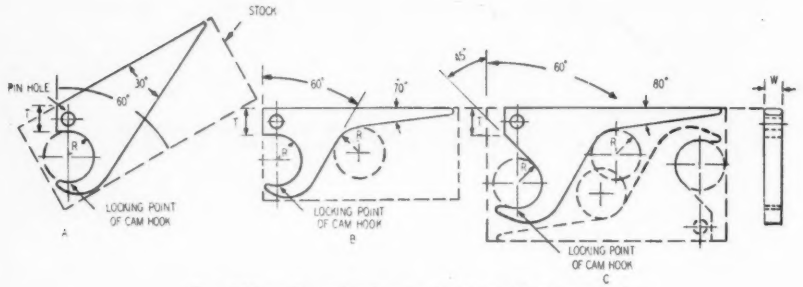


Fig. 129 — Standard cam hook latch for leaf jigs.

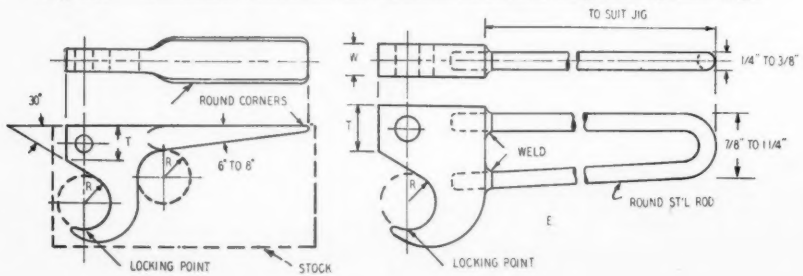
1½ times the width of channel, the floor of the jig may warp. Warping is due to strains which were "locked" in the metal by the rolling process. Cold rolled steels will warp more than the hot rolled product when machining. Original warps in small jig bodies are removed by clamping the body in a vise and using a wrench to straighten and then reducing the high spots in a surface grinder. Large jig assemblies may be straightened in a screw press or an arbor press, using blocks conveniently placed under the work, and followed by surface grinding to "true up" the remaining irregularities.

Attention is directed to the small relief in the two corners of the jig channel to clear the edges of the work and to aid in removing chips and grit. At *B*, the square slot relief should not be used; it will cause chips to gather and become compressed and wedged within it, thus causing false locations of the work. A much better design for relief is shown by the 30° angle in the opposite corner and is one easier to machine. Jigs are more easily cleaned and kept so, if several "scavenging" holes are drilled through the body walls where space and structure permit. In large jigs such holes also decrease the weight of the tool. Light weight is an important factor in tools that must be handled manually.

The four legs should be made by straight cuts as seen at *C*. Angular sides as indicated at *D* consume extra time on the milling machine and add nothing to the utility of the tool. If the legs are straight, all of them can be cut in one setting of the work. The left end of the leaf can be square; rounding its corners takes unnecessary time. Pin *E* driven in the right end of the leaf is a finger hold. Latch *F* can be released with the thumb while the forefinger is under the pin; the leaf is then opened by lifting. Jigs should be as light as possible commensurate with their necessary strength with sharp corners rounded slightly for conveniently handling the tool.

End gage pins *G* are shouldered and each has a flat milled on its side. The flats lie against the work, prevent undue

Fig. 130 — Standard cam hook for medium sized and large, heavy, leaf jigs.



wear when loading and unloading the work and provide for easy correction if they wear excessively. Gage pins are made of drill rod hardened, ground and have faces lapped.

The channel of the legs is relieved 1/32″ deep as at *H*, to clear the leaf and permit free action when opening and closing. A burr relief 1/32″ deep is provided around each of the side bushings within the walls of the jig to free the work when it is ejected. One of these reliefs is seen at *J*. Clearance hole *K* through the leaf is made 10% larger in diameter than the drilled hole through the work which furnishes a clearance edge that shears off most of the burrs when the drill breaks through.

Small drill jigs of this type will stand up better and wear much longer if the body is pack case hardened after stamping drill sizes and part numbers and before the bushings are press fitted in the walls. Pack case hardening usually distorts the jig and it must be straightened in a vise and then surface ground lightly. Case hardened jigs prevent making the erroneous starts that produce nests of holes around bushings in soft jigs, and this can easily occur unless the jig body is hardened. Shouldered bushings serve to prevent this trouble to a limited extent.

Ejecting Work from Drill Jigs

After drilling all the holes in a work piece that fits the jig as closely as in this example, the work wil be "burr bound" and some device must be provided to forcibly eject it. At *L* are two views of a pin-plate which is clamped on the drill press table near the operator. After drilling, the leaf is opened and the jig is lowered over the four pins in the plate. The pins enter holes *M* in the jig and force out the work.

There are cases in which a small ejector hook can be incorporated in the leaf and designed to "hook" under the work when closing the leaf. When opening the leaf the hook ejects the work automatically. In another case where small work is not too closely confined by locating surfaces, and with no side drilling to burr-bind the piece, the following ejecting mechanism can be used. One end of the work is placed against a spring compression horizontal pin on the floor of the jig and its opposite end is snapped within the locating gages. A small ejection pin, operated by opening the leaf, raises the end of the work above the gage pins and the sudden release of the compressed spring "shoots" the work out of the tool. This method has been successfully used when drilling two small holes through the flat sides of telephone ringer armatures.

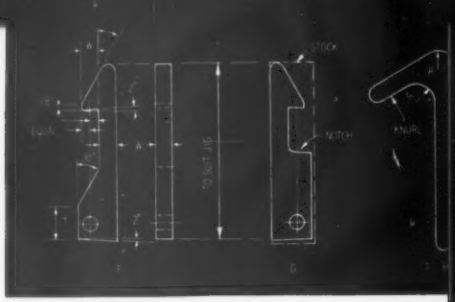


Fig. 131 — Standard latch hook designs for leaf jigs.

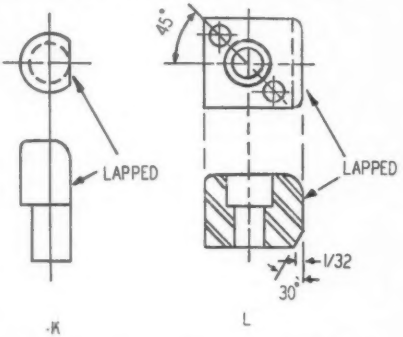


Fig. 133 — Gage pins and stop blocks.

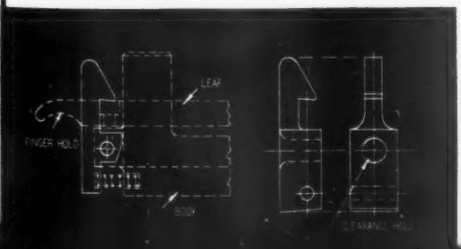


Fig. 132 — Types of special latch hooks for leaf jigs.

Drill Jig Accessories

Figure 129 at *A* shows the design of a cam-hook used for locking and unlocking the leaf in large drill jigs. This cam is pinned in the leaf through the hole shown, and can be unlocked and the leaf thrown open by one movement of the hand. The locking point is of a cam shape so that closing the hook under

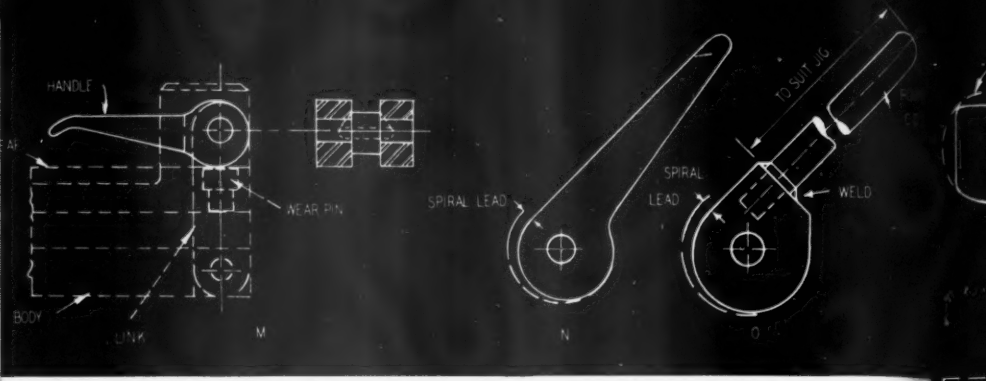


Fig. 134 — Edge cams for locking leaf and clamping work.

a positive pin in the jig body draws the leaf down tightly.

At *B* is the same type of cam but designed for small to medium sized jigs. At *C* is a layout for milling two cams from steel stock which is generally used for making only one; this layout saves time and tool steel. Dimension *T* indicates the thickness of the leaf; *W* is made from 3/16" to ½" according to the size of jig and the holding power required. Cams are of carbon tool steel hardened, ground and tempered to medium hardness. All types of cam-hook latches are fast in operation.

Figure 130 at *D* shows a cam-hook latch provided with a wide convenient handle to ease pressure on the operator's hand. For quantity production these cams are made from forged steel blanks. At *E* is a cam-hook design for very large jigs. The head of this cam is made from machinery steel and pack case hardened. Dimension *W* should be ½" thick or more. The open handle, made of steel rod, saves steel and excessive machining and it is also comfortable to use.

Figure 131 shows a design at *F* for an ordinary latch-hook that is used frequently. Here, the leaf thickness is indicated at *T*, and *W* is made of sufficient size to support the work on the leaf against the drilling thrust. Latch-hooks are generally pinned in the leaf, but are sometimes pinned in the jig body as seen at *I* in the next figure. Latches are milled from ground tool steel stock, then hardened, tempered to medium hardness and given a light finishing grind.

At *G* the purpose of the notch is to support the leaf when the jig is not in use. This prevents the screws or equalizers which may be mounted in the leaf from contacting and injuring gage pins, blocks or bushings on the floor of the jig. The latch-hook at *H* is pinned in the jig leaf and, by using the knurled finger hold, the leaf can be unlocked and thrown open by one movement of the hand.

Figure 132 at *I* shows a special latch-hook that is pinned to the jig body and that locks over a hardened wear pin in the leaf. By placing a forefinger under the finger hold on the leaf, the latch can be instantly unlocked with the thumb and the leaf opened.

At *J* is a design for a specal latch-hook frequently used when it is necessary to pass the drill through the latch to reach a bushing that is unavoidably located under the latch.

In Fig. 133 at *K*, a standard gage or locating pin is shown. The material is drill rod, hardened, ground and lapped on its gaging surface. As the flat locating surface wears from loading and unloading the jig a new flat may be ground on the opposite side after turning the pin around.

At *L*, the stop or gage block is of tool steel, hardened, ground and lapped on its gaging face. The 30° relief clears chips and dirt when cleaning and loading a jig having the stop mounted on the jig floor. Stops are usually secured by one screw and two dowel pins as indicated in the sketch.

Figure 134 shows three types of edge cams. At *M* a quick locking cam is attached to a link pinned in the jig body. The cam locks and holds against two wear pins in the leaf. In operation, the handle is lifted to unlock the cam and a continued movement of the cam and link clears the leaf which can then be

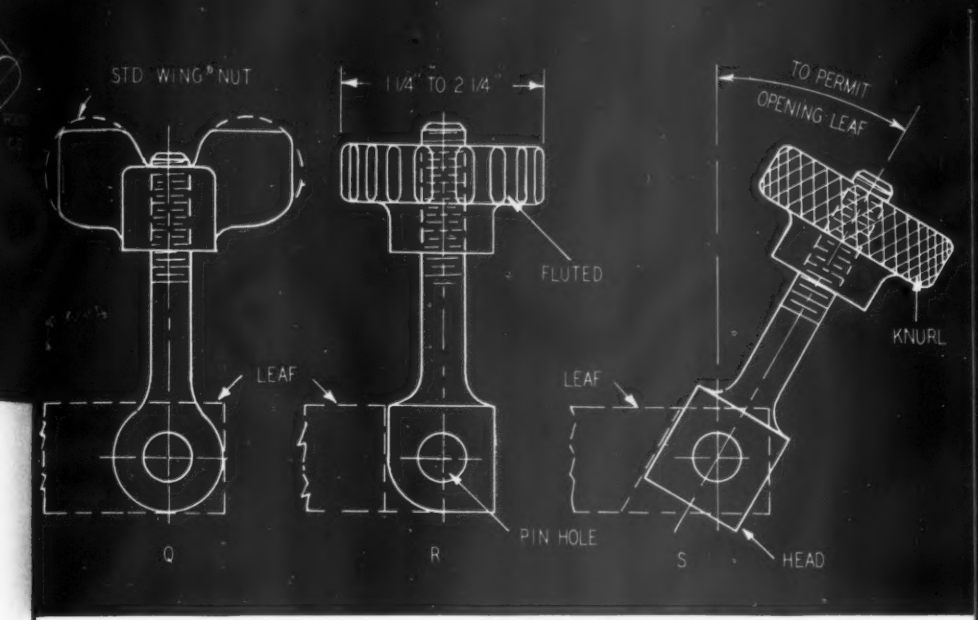


Fig. 135 — Standard draw bolts and clamping nuts.

opened. When the link is pinned to the leaf and the cam locks against wear pins in the jig body, the cam handle and link are lifted to unlock and open the leaf in one continuous movement.

At *N* is a sketch of the cam most frequently used for clamping work in jigs. It is drilled and cut from ground tool steel stock, then hardened and tempered to a medium degree. The spiral lead permits the cam to lock at any point on its edge. This is not true of a cam which is made eccentric; such cams fail to lock against work of certain thicknesses.

At *O* is an edge cam used for clamping work in large jigs. The head is of machinery steel pack case hardened. Using a round steel stock saves material and machining time and provides a very convenient operating handle.

Figure 135 at *Q* is a conventional design of a draw bolt and wing-nut for holding down the leaf of a jig. The wings of the nut can be cut down in size for clearing close spaces between jig feet or bushings near the nut. This draw bolt is made of a steel forging which is a commercial article that can be purchased in many sizes.

At *R* is another conventional type of draw bolt made in the shop. The radius in front of the pin hole permits the bolt to be turned only 90° when opening the leaf. The clamping nut is made of cast iron for which a wood pattern is necessary. The flutes on its edge are rounded for an easy hand hold.

At *S* is another draw bolt similar to the one just described but it has no radius on its head. The bottom of the leaf slot that confines the head is cut at a suitable angle to permit turning the bolt to a limited stop. This saves time when opening and closing the leaf. The knurled clamping nut can be made in quantity on a hand lathe. Clamping nuts for locking very large jig leaves are sometimes made up to 3" diameters for providing a firm hand hold. It is well for the jig designer to remember that the clamping power of a hand nut is proportional to its diameter and that one too large may cause distortion when clamping small work. All types of standard and special draw bolts are made of various diameters and lengths to suit the jig size and holding power. They are usually made of machinery steel and can be case hardened when necessary.

Figure 136 shows four types of thumb screws. At *T* is a screw jack often used for supporting (while drilling) an arm

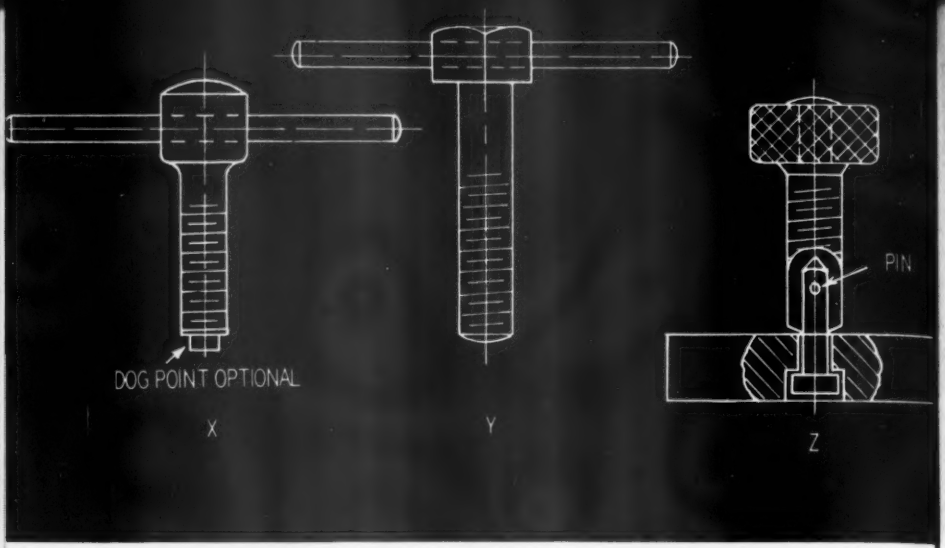


Fig. 137 — Hand screws for medium sized and large drill jigs.

or weak projection of the work after the main body of the piece has been clamped in the jig.

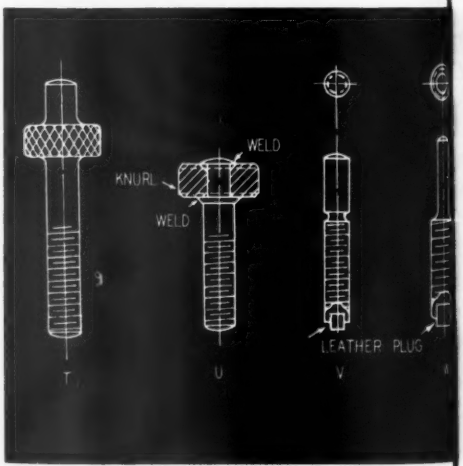
At *U* is a conventional clamp screw with a knurled head. The head is a separate piece welded on the screw body; this idea saves the time and extra material used when turning this screw from a solid bar. The screw body is drill rod and its head is made of cold rolled steel.

At *V* is a small clamp screw with no head and no knurling. This screw is provided with a leather plug and is used for obtaining a very sensitive touch for clamping plated work or delicate polished work to prevent dents or scratches. At *W* is a similar clamp screw which is even more sensitive because its head is of smaller diameter than the body. Sensitive screws should be provided with a coarse lead thread.

Figure 137 at *X* and *Y* are hand screws made by driving round steel rods through screw heads. The rods should project about 1½" each side of the heads to provide a positive finger grip. If the projection of the rod is too small it defeats the purpose and becomes irksome to operate. At *Y*, a standard hexagonal head cap screw is used for economy.

At *Z* the best method is shown for attaching a loose washer, equalizer or clamping bar on the point of a screw. This design permits easy removal of the parts when making substitutions or repairs. This is a much better method than the usual one in which the end of the screw has a shouldered shank and is riveted over the face of the piece attached. In the latter method the washer is either too tight for free operation, or becomes so loose that it wears and drops off.

Fig. 136 — Thumb screws for clamping work in light and medium sized jigs.



CHIP CONTROL WHEN MACHINING STEEL WITH CARBIDES

by Einar Almdale*

ONE of the least understood and appreciated factors in using cemented carbide tipped tools for steel cutting is the control of chips by means of chip breakers.

Although chip control was never a very serious problem with high speed steel tools, it is absolutely essential when cutting steels with carbides in view of the higher surface speeds involved. For one thing, a chip coming off the work piece at some 300 to 400 feet per minute is a potential source of danger. Moreover, if such a chip is permitted to leave the tool in a continuous coil or ribbon, it keeps interfering with the work and must be removed at frequent intervals. On some jobs—even those possessing a flexible cooling system—a long, uncontrolled chip will make it difficult to keep the coolant nozzle in place so that the fluid will cool both chip and tool as it must for maximum performance.

The most satisfactory means of chip control yet evolved is the ground-in chip breaker, which essentially is a step or obstruction ground into the top surface of the tool so as to curl up or break off the chip. Both depth and width of the breaker vary with depth of cut, feed, type of metal being machined, and cutting speed.

*Service Engineer, Carboloy Company

Effect of Chip Breaker on Tool Life

Since a chip is broken by increasing the pressure or distorting force on the chip until the desired control is obtained, it follows that the rate of tool wear must be somewhat accelerated. However, this rate of increase is nowhere near the amount often assumed. Actually, it requires extremely accurate tests to determine the effect of a correctly designed and ground chip breaker on tool life. On the other hand, the *absence* of proper chip control may make it impossible to achieve good tool life due to difficulty in properly directing flow of coolant and congestion of the chip at point of work.

Correct application of chip breakers will do much to lengthen tool life. Spasmodic deflection of coolant by a long chip results in sudden heating then cooling of the carbide tip. This may lead to thermal cracking with a resultant lessening of tool life. It is an experience not unusual on turret lathes where chip room is small and the chip is found nesting above the tool point.

Correct use of coolant also greatly assists in assuring proper chip control and prolongs the life of the breaker. Most of the heat generated when cutting steel with carbides is carried away by the chips. Keeping a heavy stream of coolant on the chip at the cutting point dissipates this heat, and the quenching of the hot chip increases its brittleness—thereby making it easier to break.

A long chip which wraps itself around the work will also cause breakage by nicking the tool above its buried cutting edge. This is most likely with the harder grades of carbides since the harder the

grade, the more easily it nicks.

Chip Breaker Designs

A good way to determine the efficiency of a chip breaker is to examine the chip it forms. A correct chip breaker will curl a chip to somewhere between ¾ of one turn and two or three turns and then will cause it to break. A shorter chip length tends to lessen tool life because it requires an excess of pressure. If the chip is too tightly coiled, it means that the breaker is exerting too much control and should be relieved slightly. Here again, pressure on the tool exceeds that required for good chip control and may result in a cracked tip, chatter, increased power consumption, etc. On light bar stock such as gun barrels, it may result in torque chatter due to the high chip pressure.

It is frequently possible—by using a loose chip breaker—to curl the chip and guide it into the chip pan rather than completely breaking it. This method deserves consideration when making light cuts since it eliminates the small narrow breakers which may tend to decrease tool life.

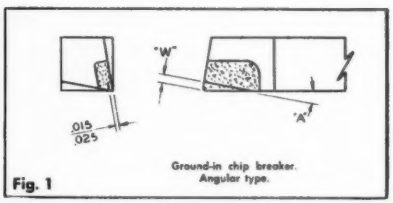


Fig. 1 Ground-in chip breaker. Angular type.

It is usually best to adapt the breaker to the job since no one chip breaker type will fit all conditions. As a starting point, reference might be made to a chart in the Carboloy tool manual GT-133-R where chip breaker dimensions for given combinations of feed and depth of cut are shown. These recommendations represent average conditions. In some instances the suggested dimensions may not give the maximum control and a slight narrowing or widening of the breaker may be necessary.

A good general rule to follow in determining chip breaker size is to increase the width of the breaker as the cross section of the chip increases. However, with feeds of 0.003" to 0.007", it may be impossible to break a tough chip. Here, increased feed may be necessary to obtain proper chip control.

Depth of chip breaker depends largely

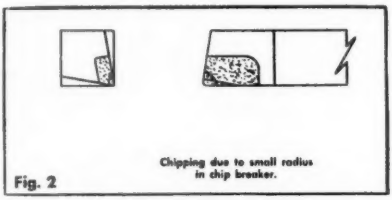


Fig. 2 Chipping due to small radius in chip breaker.

on the radius in the back of the breaker. When a new or correctly shaped wheel is used to grind a chip breaker, a depth of 0.015 may suffice. With a worn wheel, the breaker must be made slightly deeper—perhaps up to 0.025—as compensation for the increased radius and the gradual sloping of the breaker due to the changes in the periphery of the wheel.

The reason for this is that as the radius enlarges, the chip is not curled enough for breakage and proper control. But a radius which approaches a sharp corner causes the chip to exert too much pressure against the shoulder, which tends to break or nick the carbide as indicated in Fig. 2. The best radius is generally from 0.010" to 0.030". The larger limit is more appropriate for the larger breakers.

Chip Breaker Types

In Figs. 1 and 3 are shown the two most common shapes of ground-in chip breakers. The first is the "angular" type, satisfactory for the majority of jobs; the second, the "parallel" type. With an angle of 5 to 8 degrees, it is

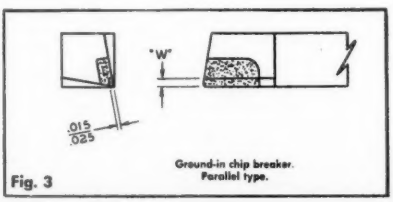
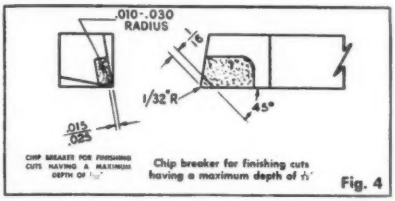


Fig. 3 Ground-in chip breaker. Parallel type.

easier to grind the angular type than the other since the grinding wheel can traverse across the tip with unrestricted motion. When grinding the parallel type, a traverse stop must be made to prevent grinding into the steel shank.

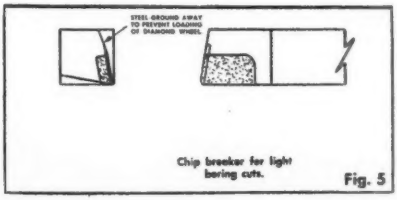


Chip breaker for finishing cuts having a maximum depth of ☆
Fig. 4

However, the regular type has these two disadvantages. If depth of cut varies—as may happen where there is non-uniform stock removal—the breaker's width may be too narrow for the maximum depth of cut, but correct for the minimum or even the average depth. This could choke the chip at the maximum depth of cut, increase the pressure and tend to nick or flake-off the carbide. Again, when an angular breaker is ground in straight tools or in tools having only a small side cutting edge angle, it may curl the chip down so that the chip strikes the shank below the carbide tip. This may gouge the shank and weaken the support under the carbide tip. The parallel type of breaker directs the chip back into the shoulder of the cut and is less likely to cause gouging.

For finishing cuts, where the angular type is most frequently used, the angle "A" may be further increased, thus reducing grinding time. The chip breaker shown in Fig. 4 produces good results in cuts $\frac{1}{32}$" deep or less and is easy to grind.

A breaker ground parallel to the end cutting edge can be used for light boring



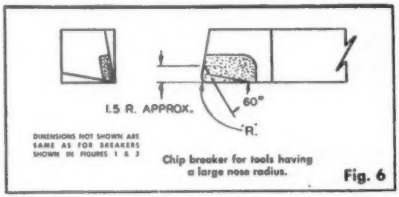
Chip breaker for light boring cuts.
Fig. 5

cuts where the chip must be broken and given directional control. This type of breaker, Fig. 5, is less susceptible to the chatter sometimes attendant upon a very light cut and provides more positive control.

Fig. 6 shows another modification in chip breaker design—an angular type which is particularly useful when the tool must have a large nose radius—as when machining to a fillet at the shoulder of a cut. Here the more conventional angular chip breaker would leave a projecting shoulder at the point where the breaker shoulder meets the radius.

Controlling Chips by Rake Angle

Desired chip control can sometimes be attained by changing the rake angles rather than by grinding chip breakers. Decreasing the rake angles to obtain a practically flat tool top—or adopting

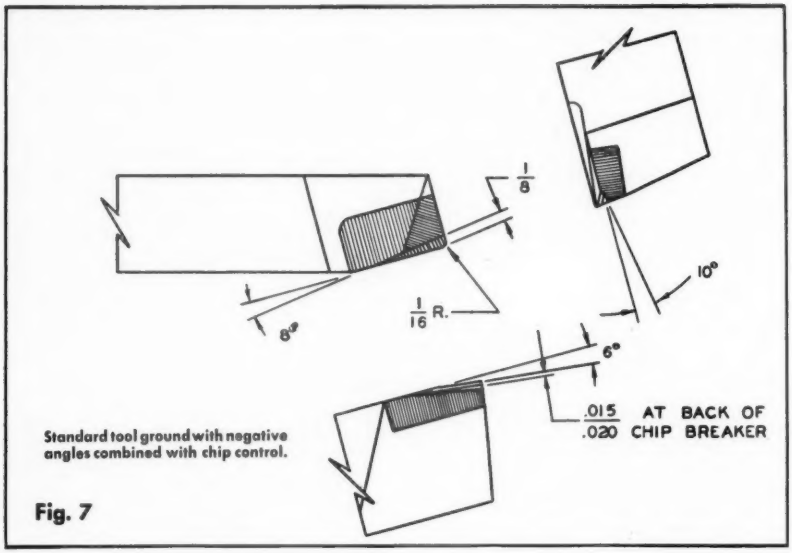


Chip breaker for tools having a large nose radius.
Fig. 6

negative angles—is the most common method of doing this. Negative back rakes give additional strength at the tool nose and also frequently serve to direct the chip in such a manner that chip breaking is satisfactorily achieved.

Negative side rakes have recently been combined with either negative back rakes or zero back rakes. This requires care since excessive negative side rakes are apt to create such heavy loads on the tool that any gain in tool strength and chip control may be offset by increased heat generation. A negative side rake can facilitate chip breaking by squeezing or compressing the chip until it breaks suitably.

The use of negative rake angles to eliminate ground-in chip breaker has the advantages of lessening grinding time; lowering grinding wheel costs; and eliminating the danger of cracking or check-



Standard tool ground with negative angles combined with chip control.

Fig. 7

ing the tip in grinding a chip breaker.

Side rake angles usually range from 8° positive to 8° negative. A negative side rake of 3° to 8° is generally necessary to give chip control without a chip breaker. Most ordinary turning operations permit the use of negative back rakes of from 5° to 10°. In selecting the amount of negative side rake, it should be remembered that in general the harder the steel, the greater should be the negative side rake.

Combining a negative rake angle with a ground-in chip breaker is another approach to chip control. This combination is sometimes necessary when an exceptionally springy chip cannot be controlled by negative rake or ground-in breaker alone. The ground-in type may not cover a sufficiently wide range of cut depths or feeds on certain operations. Negative rake angles alone might have to be so extreme that the free cutting properties of the tool would be destroyed.

A typical job where negative angles were combined with a breaker for chip control was in the machining of a dome-shaped forging of SAE 4340 steel having a Brinell hardness of 350 to 380. A Keller attachment was used for producing a facing cut on the dome contour and a constant surface speed of 240 S.F.P.M. maintained by a rheostat controlled spindle speed. A longitudinal feed of .375" per minute and a transverse feed of .750" per minute produced a chip varying from about .020" thick at the O.D. to .004" thick at the center. The depth of cut throughout the operation was about $\frac{1}{16}$".

Had the chip thickness and depth of cut been constant, this operation would have been no problem. The varying chip thickness, however, made it difficult to obtain a chip breaker which would work for both the .004" and the .020" chip thickness. Much experimenting evolved the chip breaker shown in Fig. 7, which solved the chip control problem. Good chip control enabled a steady flow of coolant to reach the tool and production per grind increased greatly. This tool was made from a standard tool by grinding a portion of the top face at 6° negative back rake and 0° side rake as shown. The chip breaker was ground into the tool at 10° negative side rake and 6° negative back rake.

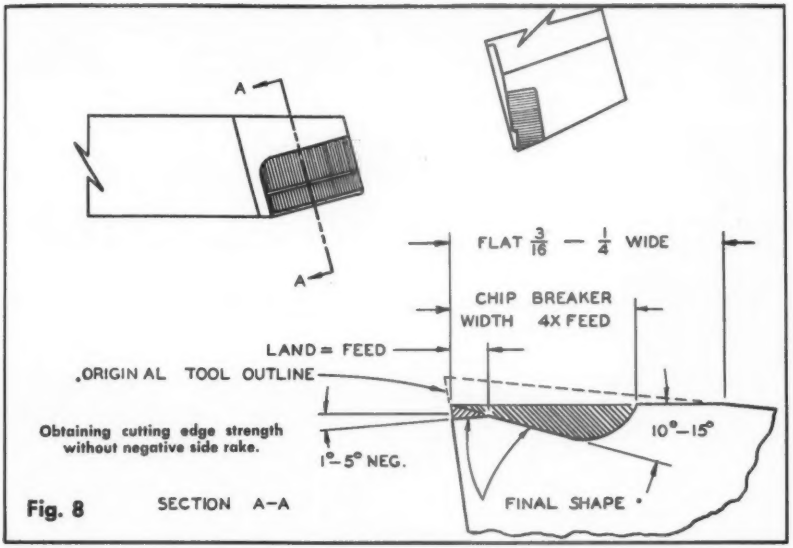


Fig. 8

Fig. 8 shows a tool which works well for turning stainless steel. It can be made from a standard tool as follows: Grind a flat or zero rake surface approximately $\frac{3}{16}$" to $\frac{1}{4}$" wide on the top face of the tool as indicated. Grind a chip breaker in the tool at a side rake angle of 10° to 15° positive and about four times the feed in width. With the tool on a pedestal grinder and the table set at from 1° to 5° negative angle, grind a land equal to the feed in width. This combination keeps power consumption and load on the tool at a minimum yet gives the cutting edge much of the strength of a negative side rake tool.

Grinding the Breaker

Chip breakers should be ground in after rough grinding and before the radius and cutting edge are finish ground since the small vibrations set up in the grinding machine tend to slightly flake the cutting edge during surface grinding. Finish grinding and a slight hand honing remove any raggedness of edge after the chip breaker is ground. Kerosene is generally considered the most economical and satisfactory grinding coolant, although cutting oils, olive oil, soluble oils, soda water, and plain water also give good results.

The steel shank behind the carbides should be ground away by an aluminum oxide or silicon carbide wheel before the breaker is ground in the carbide. The diamond wheel must not touch the steel shank since this would create excessive wear of the wheel might even damage it. Reversing the diamond wheel frequently will give more even wheel wear and will reduce the necessity of re-shaping the wheel at regular intervals.

***Editorial Note:** The privilege granted us by The Bell Telephone Laboratories justified rearranging our editorial schedule to permit featuring the story of the Optical Profile Lathe this month. Consequently, we are holding the second part of "Accuracy and the Geometry of Precision" for our January 1944 issue. E.W.P., Tech. Ed.*

PULL TO DROP TAKE-OFF GEAR
THIS INTERLOCK MUST BE OPERATED BEFORE THE HEAD CAN BE STARTED FORWARD
HIGH VOLTAGE CONNECTION
3 2 1 0 1 2 3
LOCATION AND LENGTH OF WHEEL TRAVERSE
BRAKE
POSITION #1 — OFF
POSITION #2 — ON
PUMP SPEED 700 S.S.F.
GOVERNOR SET AT 70 S.S.F.
GOVERNOR SPEED WHEN TESTING SPEED LIMITING GOVERNOR. FUEL OIL VISCOSITY MUST NOT EXCEED 70 S.S.F.

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GORDON B. THAYER*
Technical Consultant

PRESENTING RECENT NEWS, VIEWS AND TRENDS

Plastics Press Extrusions

THE PURPLE HEART . . . Distinguished War Use for "LUCITE"

"THE many wartime uses of 'Lucite' methyl-methacrylate resin range all the way from giant bomber nosepieces to tiny circular level vials used with Army lighting equipment. One of the most recent and distinguished uses for which this plastic has been specified is the background of purple used in the Army's Purple Heart Medal, America's oldest military decoration.

"The complete decoration is in the form of a bronze heart with a bronze silhouette of General George Washington in the center of its face. This is mounted on the background of 'Lucite' which, besides toning up the appearance of the award, will withstand the ravages of time. On the reverse side is a raised bronze heart with the inscription 'For Military Merit,' and the name of the recipient. The ribbon is purple with white edges.

"The Purple Heart was first authorized by General George Washington in 1782. Reestablished in 1932, it is now conferred on Army personnel for a wound requiring medical attention which is received in action with an enemy of the United States. It is also awarded posthumously to the next of kin of officers or enlisted men killed in action or who die of wounds received in action."

★

"The light-piping properties of 'Lucite' methyl-methacrylate resin, originally employed on the attachments of throat lights and surgical instruments, are now being utilized on the tip of a portable light to inspect the inside casings of shells manufactured at allied war plants. The plastic tips, which are tailor-made to fit the size and shape of different shell cavities, provide strong, shadowless illumination without the use of reflectors."

DU PONT PLASTICS BULLETIN, VOL. 5, 1943.

**Research Engineer, Dow Chemical Co.*

COMPAR

A new name to add to the growing list of synthetic plastics is "Compar" — a group of coal-limestone-and-air derivatives which might be called the missing link between plastics and synthetic rubber—notable for its immunity to the new hard-to-handle aviation "super fuels". The development of an almost endless chain of compar variations by the Resistoflex Corporation of Belleville, N. J., grew out of the demands of the aircraft industry for a flexible material to handle toluol, xylol and benzol. These are the ingredients which give the potent new U. S. super-gasolines their tremendous power but which quickly destroy most organic materials.

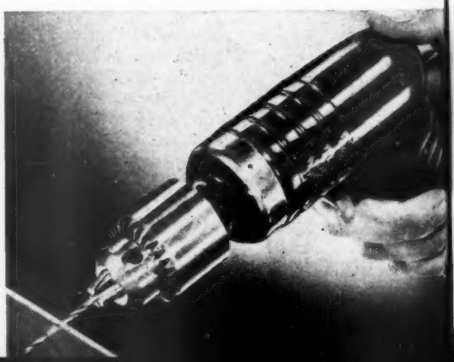
The compars are described as "transparent, flexible, rubber-like plastic materials, five to twenty times more wear-resistant than natural rubber, and the most solvent-proof rubber substitutes yet developed." Some of the compars are already in use in warplane fuel and hydraulic hose, naval diesel engines, chemical warfare equipment, in Sperry gyropilots, and in the form of protective gloves, aprons and shoe-coatings for workers exposed to irritating petroleum solvents. Scores of other war uses are said to be in the development stage, while many post-war applications are planned when the new aircraft super-gasolines are available for civilian cars and trucks.

The name "Compars" distinguishes between the basic polyvinyl alcohol resins, which are water soluble powders, and their many derivatives, compounds and modifications which have physical properties entirely unlike the original resin. The name of these latter rubber-like materials evolves from the letters in the words "COMpounded Polyvinyl Alcohol Resin".

This new plastics family group is noted for pronounced flexibility, toughness and abrasion resistance. Some compars are not only resistant to, but chemically entirely unaffected by the action of organic solvents including the aliphatic and aromatic hydrocarbons, the chlorinated hydrocarbons, the ketones, etc. Others exhibit very low permeability to industrial, refrigerant and military gases, are of high tensile strength, and are immune to aging or oxidation. Great progress has been made in widening the already large range of operating temperatures within which compar retains its other valuable properties. Some varieties will remain flexible at temperatures as low as —70° F or as high as +300° F. Others have been so modified as to be insoluble in water at all temperatures, with swelling limited to 10%, and water absorption to about 15%. Development work now in

TENITE

The lightweight Tenite plastic housings on rotary pneumatic drills have enabled women operators to perform man-size drilling jobs with greater accuracy and less fatigue. The natural-fit grip and smooth contours combine with the advantages of light weight to permit the development of a "sensitive" drilling technique. A long-lived attractive appearance is assured because of the resistance of Tenite to chipping and denting. In the design of the handle thought has been given to the operator's comfort over long periods of manipulation.



Excellent electrical properties, lightness and transparency are predominant characteristics of this molded STYRON battery case.

progress indicates the possibility of still further decreasing the water sensitivity of these compounds.

The production of the compars into rigidly specified forms requires an unusual combination of methods including some common to the plastics industry and some used in the manufacture of rubber. It is milled, for example, as is rubber, but instead of building up the customary blanket on one of the rolls, a thin cohesive film is produced which is not completely fused and is not at all comparable in consistency to either milled or calendered rubber stock. Unlike rubber, it need not be vulcanized. Further transformation into finished and semi-finished products is accomplished by extrusion or molding.

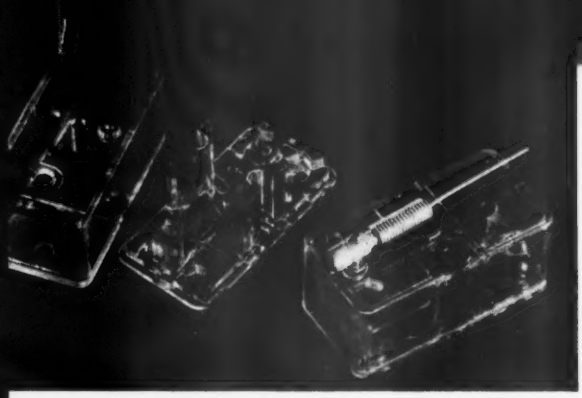
IN the exacting technology of war, products and applications destined for the consumer field are undergoing great development.

A glimpse of the postwar world and such revolutionary products as non-shatterable plastic optical lenses, "featherweight" household appliances, plastic upholstery fabrics which can be simply "dusted," and window screens of woven, translucent plastic "threads" which can be raised and lowered like an ordinary window shade, is afforded in a comprehensive report of the year's developments in the plastics field just released by The Dow Chemical Co.

Developments in the plastics field during the past year, the report indicates, should open up an entirely new scope of peacetime design, and hitherto undreamed of conveniences and improvements in articles of daily household use may be expected when these materials can be turned over to the manufacture of civilian goods.

Already proven as excellent from the standpoint of electrical insulation and resistance to corrosion, the new and improved plastics are almost daily finding new applications which have great civilian as well as military significance. Some are currently being fabricated in the form of pipe, pipe fittings and flexible tubing; others are being woven into colorful, dirt-resistant fabrics and flexible, rustless open-mesh screening. Still others are being developed into packaging materials which are revolutionary both in appearance and the protection afforded. Enhanced appearance, coupled with improved physical properties and versatility, point toward a "plastic age" in the years following the war.

SARAN extruded tubing and injection molded fittings. Pipe fittings are designed so that their strength is equivalent to the pipe, and leaking pressures are at least 40% of the pipe bursting pressures.



Molded STYRON switch housing. A good example of precision molding of an intricate shape of highly functional mechanical purpose.

Today, Dow plastics, because of their wide range of properties, are going into many applications. Ethocel (Dow Ethylcellulose), Styron (Dow Polystyrene), and Saran (Vinylidene Chloride) have all undergone great development, as has styrene, chemical antecedent of polystyrene, which is currently being used as an essential ingredient of GR-S synthetic rubber.

ETHOCEL

Outstanding among the developments with regard to Ethocel has been the introduction of the LT (material having high impact strength at low temperatures) formulations in the injection and extrusion fields. This new material is outstanding by virtue of its retention of impact strength at subzero temperatures, the actual strength being improved by a factor of approximately four as compared with more familiar ethylcellulose materials.

STYRON

Polystyrene is a well-known thermoplastic material. While its history goes back more than a century, commercial production is comparatively recent. Under its trade name, Styron, polystyrene has developed as a molding material whose unique properties and characteristics give it an extraordinarily wide range of usefulness. These properties include chemical resistance, water resistance, low specific gravity, high impact strength at low temperatures, clarity and high index of refraction, excellent electrical properties and ease of moldability.

Styron has been made available in developmental quantities in the form of an extremely fine fiber, averaging about one micron in diameter. With newly developed low pressure molding techniques, this material may be used to produce large shapes. The density of the molded material may be controlled from 6 up to the density of Styron 1.05. Electrical, thermal, and acoustical properties of these low density forms are extremely interesting.

SARAN

Saran as a basic plastic material has proved its versatility, and the developments in the field have progressed in many directions. It has proved its worth in the field of extruded tubing, pipe, films, filaments, coatings, and moldings. Many of the developments have now reached the commercial stage and are being taken almost in their entirety by the Armed Forces, or have been accepted by industry and are used indirectly in assisting the war effort.

Demands for Saran material far exceed the supply. For this reason it has not been possible for Saran to enter to any degree into those nonmilitary applications for which it is peculiarly adapted.

ETHOCEL molded portable radio cabinets. Here the material and design considerations must be such as to insure a minimum of strain, thus forestalling dimensional changes.

BY USING VICTORY TOOL SHANKS

1. Victory Tool Shanks cast of tough, long-lasting Meehanite Metal eliminate the use of much critical steel. You cement carbide tips directly to the non-critical cast shanks. 2. They lengthen tool life — because the coefficient of expansion of Meehanite is closer to that of carbide than is steel. That means a much better bond. 3. They protect tool life — because Meehanite has twice the damping capacity of steel, and so reduces chatter and vibration. 4. They speed up work in grinding — because Meehanite does not load the grinding wheel as rapidly as steel. 5. They save precious time — because they require a minimum of machining before use.

WRITE for a copy of Bulletin No. 53 T-2 which illustrates standard sizes stocked for immediate delivery. Pick out a size you can use and ask for free samples. Prove for yourself, in practical use, the superiority of Victory Tool Shanks.

THE Cooper-Bessemer CORPORATION
DEPARTMENT J., MOUNT VERNON, OHIO

(CONTINUED FROM PAGE 95)

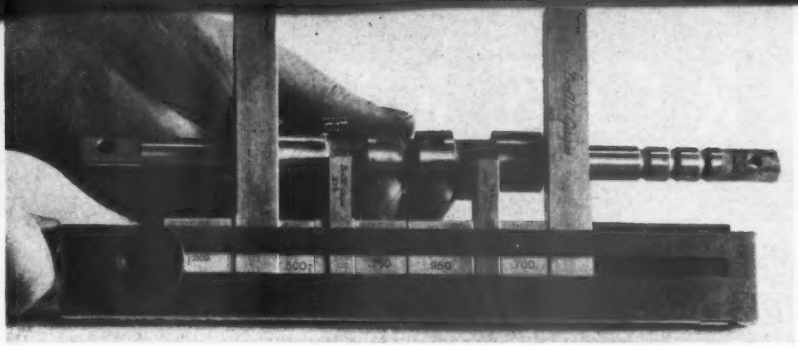
ample, the production of a spool for a hydraulic valve to controlled dimensions of high accuracy. If these are to be manufactured in great quantities there is justification in spending a large amount for all of the necessary production gages, and the cost per unit will be low because of the large quantity involved. Next, consider the manufacture of a small quantity of the same device, say 50 parts. Here the cost of special production and inspection gages might easily be greater than the cost of producing the pieces themselves. This is where the proper use of precision gage blocks and their accessories is economically sound, for a manufacturer can, within a matter of minutes, make up his necessary gages with his gage blocks and instruments. These assembled gages will be more accurate than any that he otherwise could make for himself. The cost would be slight and even though the gaging jaws should become so worn as to need replacement, the cost would still be less than the cost of making a special gage of the same dimension.

In using comparators to determine whether parts being manufactured come

Gage blocks can be used for setting height gages to dimensions involving fractions of "thousandths" and also for checking accuracy of location of the height gage vernier plate.

with specified limits, it is almost impossible to set them accurately without the use of precision blocks for then we have recourse only to some form of vernier or micrometer. Both of these tools admirably serve their purpose within the range of accuracy for which they are designed but they should not be used for measurements of a precision for which they were never intended.

When production requirements justify the making of a special snap gage it may be finished to size by the aid of a shop or "working set" gage block. With care and skill and temperature consideration the snap gage can be made to approximate the accuracy of an "inspection" block (plus or minus .000004") within a few millionths of an inch.



A high-precision multiple snap gage may be quickly and cheaply made up of gage blocks, caliper jaws and holder. After it has served its purpose, another special gage may be made from the same fixtures at no additional expense.

One measurement which is difficult to determine accurately without precision instruments and gage blocks is an angle expressed in minutes and seconds. Precision gage blocks and sine bars are capable of measuring angles to a very high degree of accuracy. The sine of an angle of one second of arc, of one inch radius, is approximately 4 millionths of an inch, hence the sine of one second of arc on a 5" sine bar is approximately 20 millionths of an inch. Because the DoAll vernier gage block is calibrated in increments of 10 millionths of an inch, using this vernier gage block in a stack of blocks with a 5" sine bar makes it possible to measure angles as fine as one-half second of arc. When it is realized that one-half second of arc is then $\frac{1}{2{,}592{,}000}$ of an inch, the high degree of accuracy possible in these precision tools can be appreciated.

Such precision is often necessary in linear dimensions. A certain disc used in part of the equipment for our bombers calls for an overall limit of ¼ of a "tenth", or 25 millionths of an inch. In the standard sets of gage blocks, while their accuracies are within a few millionths of an inch, the "buildable" dimensions of a standard series are in steps of .0001". Therefore, control of the dimensions of this part with a standard set of gage blocks would be 400% beyond the limits specified. By introducing the DoAll vernier gage block into the stack of blocks, a dimension for the combination can be attained that is within less than half of the limits specified.

Proper calibration of any indicating comparator is best done with gage blocks; an internal dial indicator can readily be set with gage blocks and instruments; checking the parallelism and dimensions of plug gages, thread gages, ring gages or manufactured pieces of similar shapes is best done with gage blocks and their accessories.

The invaluable uses to which monochromatic light and quartz optical flats can be put are becoming more generally appreciated. The initial dimensional accuracy of gage blocks or other fixed standards may readily be determined by these devices. Inspection of flatness and parallelism may be quickly made by an easy set-up. A plug gage may be checked simply by placing it and a corresponding gage block on an optically flat surface. Upon these two is then placed an optical flat and, when this set-up is viewed by monochromatic light, an immediate determination can be made of the actual size of the plug and of any taper.

The application of light-wave technique, thru the media of monochromatic light and optical flats, not only makes possible the recognition of gage block wear but, as a consequence, permits the use of worn gage blocks without any degradation of the measurements being undertaken.

The gage block is our most accurate mechanical means of establishing dimensions and altho wear nominally detracts from accuracy, when that wear can be measured and charted in tangible units, the gage block has lost none of its utility. This, in effect, permits economies as to the expense of new blocks and the reconditioning of old blocks.

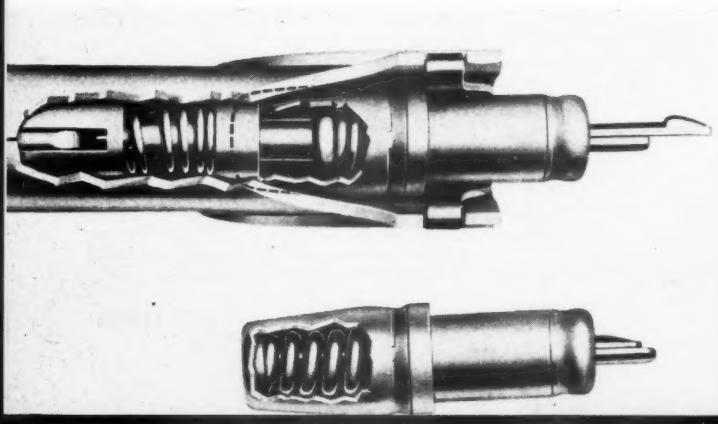
PROGRESS ON P

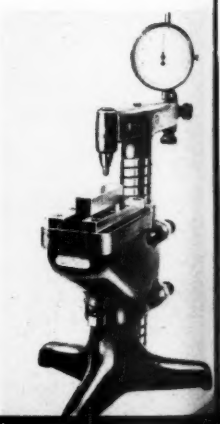
THE Prestole Division of the Detroit Harvester Co., Toledo, O., recently announced two new safety developments designed to cut the high accident hazard in the use of airplane skin fasteners. First, a cap is added to the conventional fastener, preventing retrograde movement of the spring and fastening element in the event of failure and so elminating the hazard of flying parts. Second, the company's Prestite Safety Gun has been redesigned so that the plunger which actuates the fastener extends within the cup, thereby eliminating the possibility of the fastener shooting out of the gun or becoming disengaged due to the improper placing of the fastener in the inserting tool. 757-F

THE American Amplifying Gage, manufactured by the American Gauge Co., 126 Bayard St., Dayton, O., is a ruggedly built and extremely accurate visual gage for checking thicknesses and diameters up to 5" in "tenths". The indicator reads in ten-thousandths and has a range of .030". These gages are used for gaging pistons, piston pins, valve stems, bushings, drills, etc., as well as in toolroom work. The threaded column is used for approximate adjustments and a knurled nut, directly under the indicator, is held firmly in the desired fine adjustment position by a lock nut. Gage blocks or masters are used for the setups. 103-F

A MACHINE for use in finish milling four cam slots in aircraft propeller cams has been developed by Snyder Tool & Engineering Co., Detroit, Mich. It is equipped with four spindles to mill the four slots at one time. These spindles are mechanically inter-connected (each having its own hydraulic cylinder) and go through rapid approach and feed into the work in small steps while the work piece reciprocates and rotates in conformity to the master cam producing the cam contour. The master cam is integrated with the mechanical motion of the fixture and is designed with a rise-to-length ratio of one in five. 466-F

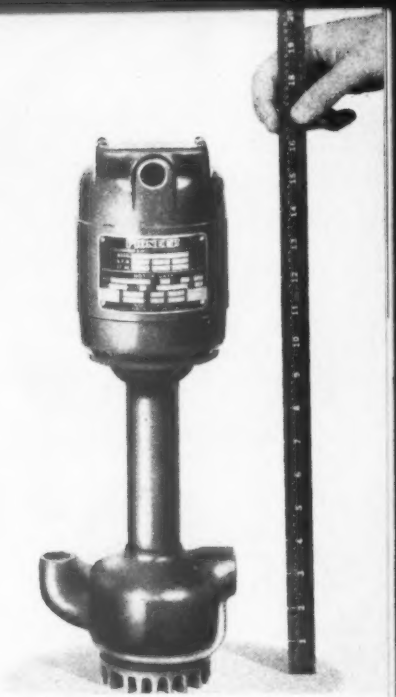
A PNEUMATIC die cushion that is completely self-contained and easily mounted directly to the bolster plate of practically any power press has been announced by the Dayton Rogers Manufacturing Co. of Minneapolis, Minn. The design of this new Model CB includes an all hardened and ground pin pressure pad that can be fitted to the press bed openings of the individual presses used, thus increasing the pin pressure area to the maximum capacity of the press bed opening. These pneumatic die cushions are now built in sizes from 6" to 24" having a drawing capacity from 2" to 12" and will develop ring holding pressures of from 1½ tons to 23 tons on 100 lb air line pressure. Each cushion is supplied with a combination reducing regulator and valve and pressure gage. 619-F



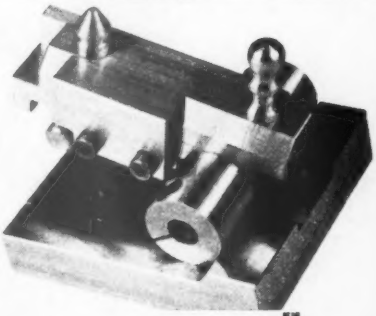


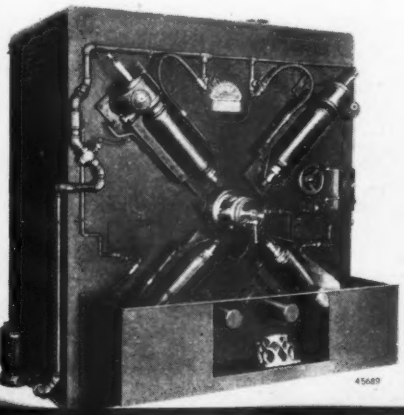
PARADE

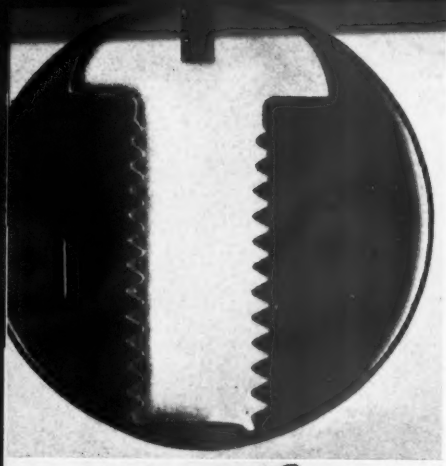
A SMALL sized seal-less pump, identified as Model MVA, has recently been announced by Pioneer Pump and Manufacturing Co. This small pump was designed to meet the need of operators of small machines such as hand mills, surface grinders, internal grinders, drill presses, tapping machines, etc. It is just short of 16" in height and has all the characteristics that were built into the full sized counterparts recently developed by this company. This model is described as a submerged type pump and is intended for machines having a coolant pump in their base or for machines provided with separate coolant tanks. 427-F



THE Sine Angle Wheel Dresser has been developed as an aid to speed and accuracy in wheel dressing for angular form grinding. This new tool eliminates the necessity of costly special equipment or the alternative of time consuming makeshift set-ups for dressing the wheels of surface grinders to the required angles. Employing the familiar sine-bar principle and with the aid of standard gage blocks or adjustable parallels, wheels may be quickly dressed to any angle from 0° to 90° and within a claimed accuracy of plus or minus 10 seconds. For any given angular setting the required gage block "build up" is arrived at by multiplying the sine of the angle by two and adding .300". Write Florian Mfg. Co., Plantsville, Conn., for bulletin. 758-F





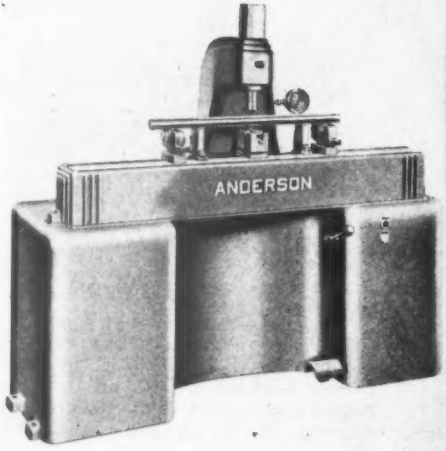


"NO-KASE" is a stop-off paint for selective carburization on steel parts in liquid carburizing baths which has been developed by the Park Chemical Co. of Detroit, Mich. This new compound is applied as paint, thus providing protection from carburization on such difficult sections as threaded edges. Within an hour after "No-Kase" is applied it is sufficently dry for immersion in the carburizing bath. The heat of the bath burns out the vehicle of the paint and leaves the pigment as a continuous metallic coating. Any of the coating remaining after carburizing and quenching is easily removed by wire brushing. **756-F**

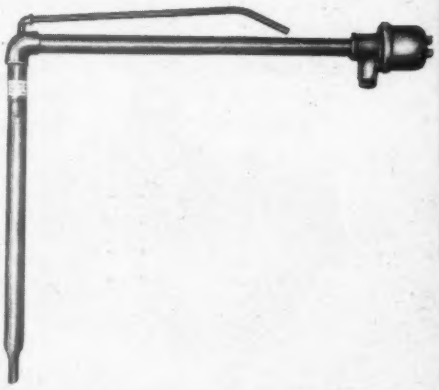
THE Xactor, manufactured by Industrial Engineering Co., 141 W. Jackson Blvd., Chicago, Ill., is designed for accurately measuring angles of drill points, tool bits, machine ways, depths of deep holes; for sketching and laying out tools and machine parts, dies and jigs; and inspection of manufactured parts. Its adjustable lock-type sliding scale pivots the full 360°, assuring instant measurement of any angle to an accuracy of ½ of 1°. The Vernier turret and the sliding scale can both be locked at any specific location, thereby enabling accurate gaging when many items of the same size or angle must be checked. **618-F**

THE Angle Computer Co., 5720 Melrose Ave., Los Angeles 38, Calif., is now manufacturing the new Studler Angle Computer, Model C, designed to insure the accurate survey of precision measurements and angles involving vertical, horizontal and related angles. The protractor and vernier on this unit are calibrated to give readings to one minute of arc. This instrument affords both horizontal or vertical working positions at all times and from either of these positions the work can be rotated a complete revolution. The face plate of Model C is 10″ in diameter and 1″ thick. An interchangeable surface plate is 5″ x 10″ x ⅜″. Brake shoes are cast-iron and fixed in place and machined at the same time the main bearing is bored. This assures perfect alignment, so that when the brake is applied the work is not distorted or displaced. **100-F**

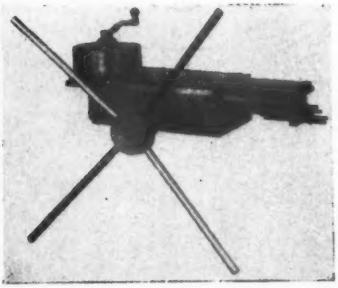
ANDERSON BROS. CO. of Rockford, Ill., have recently developed a sensitive, high speed straightening press, supplementing their line of hand presses. Although the machine has a capacity of 10 tons, it is capable of bending a shaft as little as .001". With this press it is possible to apply the exact load required to correct shaft run-out. To facilitate repetitive operation, the pressure gage which indicates the ram loading is mounted conveniently near the work at eye level. An adjustable dial indicator is located beneath the ram at the point of maximum deflection of the work piece. This indicator shows clearly the amount of shaft runout in the preloaded, fully loaded and unloaded positions. The length of the work table is 60" and several table accessories are available. **190-F**



THE Vent-Type Thermocouple, which is a new type of assembly eliminating the collection of gases and reducing contamination to a minimum, has been developed by the Claud S. Gordon Co., 3008 S. Wallace St., Chicago, Ill. A vent at the top permits the gas to escape and, by artificial circulation, admits the right amount of pure air to take its place. In some cases an air connection is made with the blower and a very small amount of air is circulated through the tube. Although a slight error may occur in the reading of the thermocouple if there is too much air, a small amount will remove the contaminating gases without affecting the reading. **759-F**



THE Racine Tool and Machine Co. of Racine, Wis., has just announced the development of a new 20" x 20" capacity metal cutting machine known as their Model No. 36C. This machine was designed primarily to provide low cost cutting of large work with a thin cutting tool. Only a small amount of metal in the form of chips is removed by the light-weight blade that is used, thus resulting in a substantial saving where multiple cuts are made. The Model No. 36C is hydraulically operated, full control being brought to a single lever and a special dual type feed is used which provides fast-cutting speed in light materials and yet is arranged for a positive predetermined rate of cutting in die blocks. **644-F**

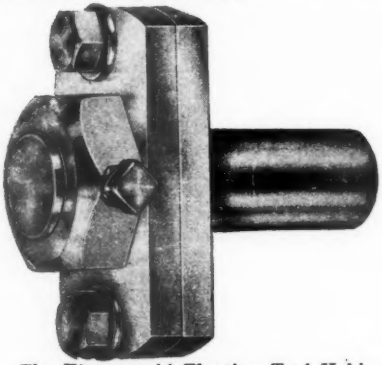


The new "Angle-Set-Magnet-Block" is designed for wheels up to 8" diameter. Larger diamonds can be set in it for larger wheels, and it is claimed that diamonds can be kept sharpened by rotating only the top nib.

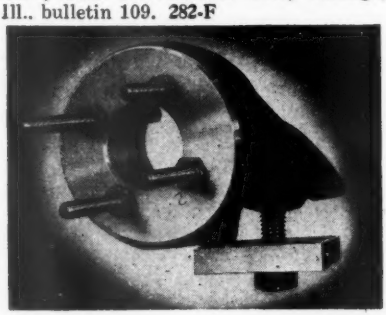
This dresser is described as comprising three units, the "Magnet-Block" 2½ x 3 x 1, containing a 12° "Angle-Set" fitted with a Big-Hed Nib containing a No. 10-CNX (1¼ carat common quality) diamond, and is equipped with two lock screws. Made by Diamond Tool Co., 935 E. 41st Street, Chicago, Ill. 633-F

A turret attachment that quickly changes an engine lathe into a hand screw machine is marketed by United Industries, 4 E. Buena Vista Ave., Detroit, Michigan. It is made in a variety of models to fit any size and make of engine lathe and is installed on the ways by simply removing the tailstock. The base, which clamps to the lathe bed, is normalized and machined to withstand heavy production usage. All gears and racks are fabricated from alloy steels, and are of standard design, thus facilitating replacement.

Lathe output and accuracy can be greatly stepped up with the use of Dix Mfg. Co.'s, 603 E. 55th Street, Los Angeles, California, new Dix-Wilder Multiple Carriage Stop. It reduces scrap, saves time, and increases efficiency. Easily and quickly installed, the new Multiple Carriage Stop clamps rigidly to the ways of a lathe in one minute and once set—always set, resulting in four accurately indexed positions. It is fool-proof and has nothing to get out of order—a novice can get accurate length and depth of cut. It is made of high quality cast iron and hardened steel parts. 784-F



The Electroweld Floating Tool Holder is designed for use in any screw machine or turret lathe and insures instant alignment of drill, tap or reamer with work. It facilitates correction of turret and spindle misalignment. Precision ground contracting surfaces assure concentricity. Shank is hardened and ground. The tool is mounted directly in holder or is secured by means of a split bushing, one of which is furnished with each holder. Furnished in three sizes ½", ⅝", or 1" hole for tool or bushing. Described in Electroweld Mfg. Co.'s, 1723 N. Ashland Ave., Chicago, Ill.. bulletin 109. 282-F



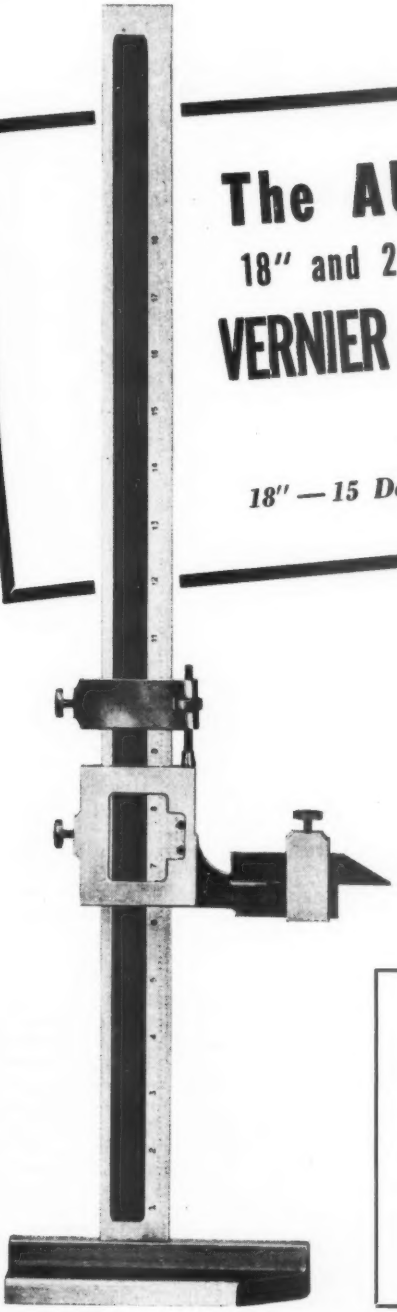
The AUTOMETRIC

18" and 24" English Measure

VERNIER HEIGHT GAUGE

Deliveries

18" — 15 Days • 24" — 30 Days



18" Vernier Height Gauge, Scriber and Case, F. O. B. Detroit,

$103.00

24" Vernier Height Gauge, Scriber and Case, F. O. B. Detroit,

$190.00

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Industrial Digest

TOOLING•PRODUCTION•WAR NEWS•PUBLICATION REVIEW

Quick Conversion to Peace Production

Westinghouse has complete plans in readiness for reconversion to civilian production as soon as war production demands slacken, it was disclosed at the Company's annual conclave of officers and managers.

Other highlights of the reports made at this meeting of the men who manage the 25 principal manufacturing divisions and the district operations of the Westinghouse Electric and Manufacturing Company included these forecasts:

1. While a period of readjustment to peacetime conditions must take place, it should be no more difficult than our adjustment to wartime conditions.

2. The pent-up demands for the goods of peace will be unprecedented. These goods in many factories and homes are wearing out.

3. The means of purchasing will exist after the war as never before—in cash, bonds and credit.

Summarizing the meeting's discussions of immediate war production problems and the Company's plans for returning to civilian production, A. W. Robertson, Westinghouse Chairman, said:

"Our planning is being done with the aim to keep our expanded production capacity occupied after the war, so far as possible, so that we can continue to provide work for the greatly increased numbers of Westinghouse people. The same ability that enabled private manufacturing companies to turn successfully to war production will assure their successful reconversion to civilian production."

The size of this undertaking was indicated by a comparison of present Westinghouse employment and production figures with pre-war figures. Employment today exceeds 106,000 people, compared with a pre-war figure under 50,000. Just a year ago, employment was 92,000. Production is about four times the average pre-war rate. During the first nine months of this year Westinghouse received orders amounting to $766,966,571 net. This compares with $153,976,777 in a similar pre-war period in 1939. Billings for the first nine months of 1943 amounted to $503,537,095 net, compared with $129,602,676 in the first nine months of 1939.

* * *

Today's research and development will provide the post-war engineer with a wealth of new materials, processes and design techniques, according to Mr. C. J. Burnside also of Westinghouse. Many of these have been noted with interest as by-products of wartime developments, which could not be applied because of our lack of manpower and raw materials.

Tomorrow's engineer must recognize a new factor: development can no longer be justified on its saving of human lives —it must pay its own way. The radio executive called this "no mean problem," emphasizing that under war conditions cost has been a secondary production factor. The engineers of today work to specifications which place performance first; reliability only second to performance; manufacturability third, to insure rapid production; serviceability fourth, to assure ease of maintenance in the field. Cost is a relatively unimportant fifth. Unlike the period of yesterday, today we have unlimited funds to press development, but no time to rationalize —no time to obtain normal balance between progress, utilization and economy. Today we are sparked by a desperate urge, where the stake is human life, not dollars.

INDUSTRIAL DIGEST

Many of the developments of today, according to Mr. Burnside, were the impossibilities of yesterday. Many of the impossibilities of today will be the commonplaces of tomorrow.

A-L Creates Carbide Division

W. F. Detwiler, Chairman of the Board of the Allegheny Ludlum Steel Corporation, Brackenridge, Pa., has announced his company's recent acquisition of the Carbide Alloy Corporation of New York City. The property will henceforth be operated as Allegheny Ludlum's Carbide Division.

"The new Carbide Division," he added, "recognizes late developments in the field of metal-working, and is calculated both to round out and enhance Allegheny Ludlum's service to the fabricating industries of the country. It should prove to be a matter of major benefit under the necessities of rush war production, and of no less importance in the peacetime aftermath."

Initial products of the company's new manufacturing division will be a line of highly developed cemented carbides, produced under processes established by Carbide Alloy Corporation.

The company's expansion into the carbide field is also a reflection of its intensive work in the field of cutting materials in general, Mr. Detwiler pointed out. Two research developments of undoubted importance to war production have preceded it: the introduction and subsequent free release to the nation of DBL High Speed Steel, which has been credited as the chief factor in the vital tungsten conservation program; and the later development of the Super DBL analysis, which carries the advantages of tungsten saving into the field of heaviest production cutting.

United Nations' Postwar Plans

ALL the United Nations are determined that out of this war shall come a finer and richer life for the average citizen, according to a survey of *Postwar Plans of the United Nations* by Lewis L. Lorwin which The Twentieth Century Fund issued recently.

The survey is a factual report on plans put forward by responsible governmental and private groups in each country for that country's own internal development after victory is won. Separate sections deal with the United States, Great Britain, the Soviet Union, China, Canada, Australia, Latin America, Governments-in-Exile, India, New Zealand and others.

"The concrete objectives are everywhere alike—an increase in the material goods of life, better nutrition, housing, health and education, as a means for a larger spiritual and cultural life of all people."

While there is general agreement on the basic goals, the report points out that the individual nations show wide differences in the governmental and economic systems by which they hope to reach these goals, "especially with regard to the role of private and public enterprise in the postwar economy."

The Fund's survey finds that "the countries of the United Nations fall into three broad groups. The first group includes the United States, Great Britain, Canada, Australia, and some countries of western Europe. Most official and unofficial plans of these countries assume that private enterprise will remain the dominant form of economic activity. Their proposals are intended to strengthen private enterprise by imparting to it a larger social purpose and by extending to it governmental aid.

"The second group includes some countries in central Europe, a number of

Latin American countries and China. The plans of these countries assign a large and permanent place to state enterprise and to other forms of collective organization, e. g., industrial co-operatives, in the tasks of reconstruction and postwar development. These countries contemplate nationalization of many basic resources as well as a large part of the heavy industries. The tendency in these countries, some of which are in the early stages of industrialization, is towards an economic system which may be described either as 'state capitalism' or 'mixed economy,' depending on the degree to which government ownership and operation will be combined with other forms of public and semi-public enterprise.

"The third group consists of the Union of Soviet Socialist Republics with its complete nationalization of economic life and centralized planning methods."

Western Electric Subcontracts 50% of Total Sales

WESTERN ELECTRIC COMPANY, in a recent report to the War Production Board and the Smaller War Plants Corporation, disclosed that 50 percent of the Company's total sales of war materials to the Government since the United States' entry into the war had been produced by subcontractors. In meeting its commitments to the Government, Western Electric Company currently does business with more than 6,500 subcontractors and suppliers.

The Company's subcontracting rate of 50 percent exceeds by 10 percent the rate which the War Production Board requested prime contractors to establish in an effort to step up the output of munitions and provide business for smaller manufacturers whose pre-war production has been shut off through the diversion of strategic materials into war production.

With the declaration of war, Western Electric was named prime contractor for large numbers of aviation radio sets. It immediately assigned part of this production to its catalogued list of potential subcontractors, conserving a part of its own facilities for the manufacture of more complex military equipment.

Effect of the subcontracting of war orders by prime contractors is a dual one. It increases production and at the same time enables smaller companies that have successfully met subcontract orders to become prime contractors, dealing directly with the Government on further war orders.

Grievance Procedure Under Collective Bargaining

Good grievance procedure, essential to all parties interested in sound labor relations, is outlined in the pamphlet, Settling Plant Grievances. Such procedure is as important to management as to labor. The grievance machinery enables management, with the help of the union, to discover and correct the sore spots in working conditions and plant industrial relations before they are permitted to spread and cause real trouble. It provides an effective communications system for bringing bad shop practices of lower supervisory help to management's attention. To the individual worker, grievance procedure provides the means of enforcing the terms of the contract and with a democratic method of appeal against any one person's arbitrary decision affecting his wages or working conditions. It protects the democratic rights of the individual in industry in the same way that our judicial system protects his democratic rights in civil life. Address the U. S. Department of Labor, Division of Labor Standards, Washington, D. C., for a copy.

INDUSTRIAL DIGEST

Tool & Die Industry Analyzes Excess Profits Tax

The Tool & Die Institute Chicago group recently undertook an analysis of the effect of the Excess Profits Tax upon the business of its members. It disclosed justification for presentation of its findings to Governmental agencies.

Consequently William R. White, Jr., vice president of Midwestern Tool Company and Chairman of the committee which conducted the Chicago survey, and Stuart H. Sinclair, secretary of the Chicago Tool & Die Institute, met with L. A. Sommer, president of the Sommer & Adams Company, and M. W. Rowell, general manager of The National Tool and Die Manufacturers Association, in Washington where sufficient encouragement was received to justify a nation-wide Industry survey.

A questionnaire form has been prepared and is now being mailed not only to members of The National Tool and Die Manufacturers Association but to all members of the Tool & Die Industry. The statistical data which will be forthcoming from plants in the several sections of the country will enable the committee to analyze the possibilities of obtaining relief, not necessarily only for the Industry as a whole but even for individual local groups.

The information which will be supplied by these questionnaires will be coded and considered confidential. Its prompt submission by Industry members will greatly facilitate the preparation and presentation of an appeal for tax relief.

Greenfield Army-Navy Award

The employees and management of the Greenfield Tap and Die Corporation, Greenfield, Mass., were proud recipients, October 23, 1943, of a Third Army-Navy "E". They now carry two stars on their "E" Pennant. In the formal announcement they state that "This high honor ——— should be shared with the distributors and users of Greenfield Tools, who made this award possible."

U. S. Patents

Among the recently issued U. S. Patents the following are of Tooling interest. If you are interested in studying any of these Patents, simply advise Patent Information Service, The Tool & Die Journal, 2460 Fairmount Blvd., Cleveland 6, Ohio, enclosing 20 cents for each Patent copy desired and we will gladly forward your order to Washington.

HYDRAULIC RIVETER, No. 2,329,709.
LAPPING TOOL, No. 2,329,720.
PORTABLE CUTTING TOOL, No. 2,329,729.
REFINISHING TOOL FOR CRANKPINS, No. 2,329,806.
GAUGE TESTING APPARATUS, No. 2,329,828.
CUTTING-OFF TOOL, No. 2,329,872.
TAP, No. 2,330,099.
WAYS FOR LATHES AND LIKE MACHINES, No. 2,330,154.
TOOLHOLDER FOR MACHINE TOOL TURRETS, No. 2,330,156.
HOBBING MACHINE, No. 2,330,168.
ELECTROLYTIC POLISHING OF METAL, No. 2,330,170.
FLEXIBLE GRINDER OR SANDER, No. 2,330,209.
DIE FOR DRAWING SHEET METAL ARTICLES, No. 2,330,228.
REAMER, No. 2,330,242.
PLANER GAUGE, No. 2,330,412.
GAUGE, No. 2,330,453.
DIE PRESS ATTACHMENT, No. 2,330,554.
STOP MOTION MECHANISM FOR DIE PRESSES, No. 2,330,555.
PRESS AND TOOL STRUCTURE FOR FORMING CAVITIES IN METAL PLATE, No. 2,330,572.
CENTERING DEVICE FOR THE CUTTING OF SHEET-METAL DISCS, No. 2,330,577.
TOOLHEAD FOR RIFLING MACHINES, No. 2,330,584.
MULTIPLE TURRET LATHE, No. 2,330,859.
PROFILE MILLING MACHINE, No. 2,330,890.
MULTIPLE SPINDLE BROACHING LATHE INDEXING MECHANISM, No. 2,330,968.
BLANKING DIE SET, No. 2,331,059.
GRINDING MACHINE, No. 2,331,089.
METHOD OF AND MACHINE FOR REPRODUCING PATTERN CONTOURS, No. 2,331,337.
PROFILE GRINDING MACHINE, No. 2,331,381.
LATHE TAILSTOCK, No. 2,331,385.
BLANKING AND FORMING DIE, No. 2,331,490.
BLANKING AND FORMING DIE, No. 2,331,491.

(TO PAGE 178—PLEASE)

S. I. P. UNIVERSAL MEASURING MACHINE

Reads Direct to .00005" and 10 Seconds of Arc

THE S. I. P. Universal Measuring Apparatus of the Societé Genevoise, Switzerland, is of massive construction and is designed for checking work either in the standards laboratory or in production inspection departments. The two carriages rest on the bed of the machine which is made of special S. I. P. cast iron of extreme hardness. The bed is of ample dimensions and is generously ribbed. The carriages move accurately on flat and vee guiding surfaces which are carefully hand-scraped, their accuracy being checked by optical methods. The measuring principle employed is that of two 90° co-ordinate motions in a horizontal plane.

The longitudinal carriage, which carries the work, has an effective travel of 16 inches. Its travel is measured by a high precision scale, secured to the carriage, and the scale is viewed by a measuring microscope fixed to the bed of the machine.

The co-ordinate travel of 4 inches is provided by the transverse carriage on which the locating microscope and other accessories are mounted. This carriage also carries a high precision scale which moves through the field of another reading microscope.

A third co-ordinate motion (vertical) is obtained by the vertical slide of the tool and microscope holder.

The standard scales are made of a special alloy which has a coefficient of expansion approximately that of the usual steel or iron workpiece. Corrections for temperature are therefore unnecessary, the only precaution being, however, that the machine and the work are at the same temperature. The scales have specular polished surfaces and the rulings thereon are spaced .050". A certificate of accuracy to within .000005" accompanies each scale. The field of view of each reading microscope covers one .050" increment of the scale and each eye-piece has a glass reticule or scale of ten divisions of .005" each. Each one of the .005" reticule divisions is further divided into 100 parts by the calibrations of the micrometer eye-piece drum. Therefore, measurements may be read directly to .00005" and the nearest .00001" may be easily estimated.

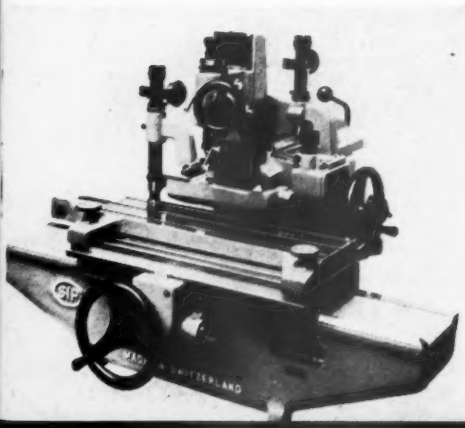
For angular measurements and for working with polar-coordinates, a precision rotary table with a 7⅞" diameter working surface mounts on the longitudinal carriage. Readings are easily taken to 10 seconds of arc by a large graduated circle with vernier.

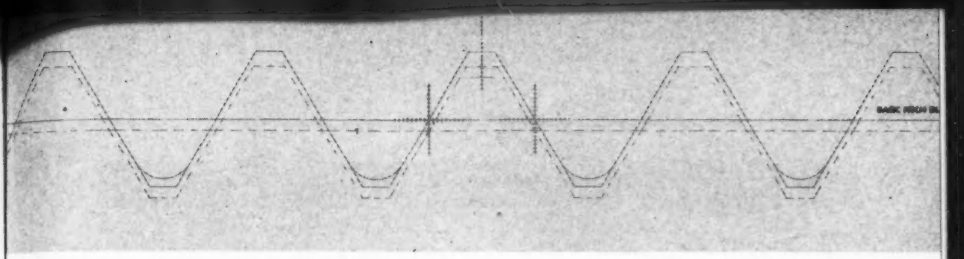
Thread profiles and other workpieces that have to be inspected by transmitted light are held between centers that can be mounted in accurate alignment with the guide ways of the longitudinal carriage.

For flat work that has to be viewed by transmitted light a table with a glass pane 16½" x 4½" is available.

Illumination of objects by transmitted light is provided from below. An optical system comprised of a light source, condenser system and objective lens provides a parallel bundle of light rays. The beam of light can be tilted to a maximum of 10° (readable by a vernier to 10 minutes) on either side of the vertical in order to conform to thread helix angles.

In addition to checking finished work, the field of application for the machine is greatly widened by a spotting tool which enables accurate layout work to be performed. The spotting tool is used interchangeably in the tool holder with the locating microscope. The spotting tool axis and the optical axis are mutually common and concentric with the tool holder bore.





MASTER PROFILES ON GLASS

PERMIT MORE ACCURATE OPTICAL INSPECTION

THE demand for and attainment of closer manufacturing tolerances have stimulated the development of more highly refined inspection methods.

Optical inspection by profile projection can be no more dependable than the accuracy and stability of the master screen profile. The higher the magnification the more critical this factor becomes. At 62½× magnification $\frac{1}{16}$" on the screen represents .001" on the work being inspected. With optical inspection being performed to limits expressed in "tenths" it is readily appreciated that the master screen profile must be outlined on a medium less affected by variations in temperature and, particularly, humidity than tracing paper or cloth. Glass is an ideal material for this purpose.

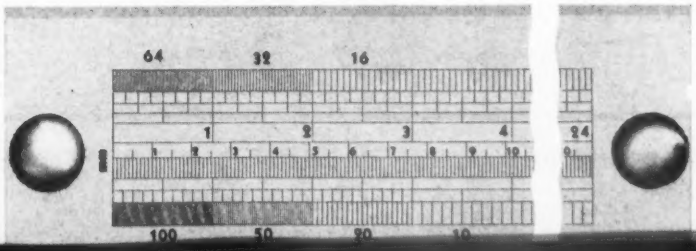
The art of accurately producing fine, dense black lines on glass as perfected by the Universal Engraving and Colorplate Company now provides a master screen profile of an accuracy and stability in keeping with the inherent precision of the most highly corrected optical systems.

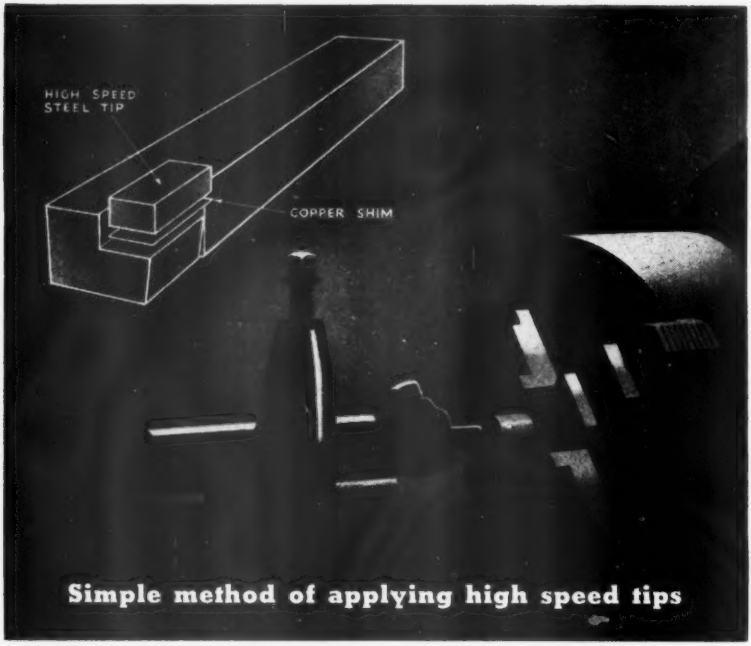
Now widely used, the company's first innovation was a series of radius charts. Each glass master chart is a pattern of concentric circles representing a wide range of radii at a standard magnification. The projected screen shadow of a workpiece profile involving a radius can be accurately compared with a chart circle of correspondingly enlarged radius. Thus inspection by optical projection becomes a technique as modern and accurate as today's glass plug gage.

For the checking of linear dimensions of magnified profile shadows on the screen, Universal's glass projector rule is an invaluable aid to an inspector. The rules are accurately calibrated in fractions and decimals of inches as well as millimeters. They are of quality plate glass, translucent, and the lines are on the side held against the projector ground-glass screen so that there is no accuracy-destroying parallax between the scale and the screen shadow.

The latest embodiment of the Universal master glass transparency is a series of Screw-Thread Comparator Charts. These have been prepared for the entire series of both American National Fine Threads and American National Coarse Threads, in either Class 2 or Class 3 Fit. On the chart the thread profile appears as at the top of the page. Additionally each chart carries tabulations of both fine-thread and coarse-thread dimensions and tolerances for that particular pitch and class of fit.

The use of the thread profile charts enables the optical inspection of thread forms to be put on a high production basis.





Simple method of applying high speed tips

Information supplied by an Industrial Publication

Copper brazing offers a readily available means of mounting high speed steel tips on low alloy shanks for cutting tools.

The procedure is quite simple. A recess milled in the shank is thoroughly cleaned and coated with brazing flux. The flux is also applied to the high speed steel tip. A copper shim (0.003 to 0.005 in. thick) is cut to the size of the recess.

The shank is heated until the flux flows freely before the shim is fitted in the recess. After the shim and tip are put in place, the assembly is brought up to 1650° F., in a preheating furnace.

Then the assembly is transferred to a high heat furnace and held at quenching temperature (2200-2350° F.) until the tip is soaked through. Copper melts at 1980° F., therefore the shim will melt and spread over the interfaces, forming a firm bond.

After withdrawal from the furnace the tip is aligned and pressed into place to squeeze out excess copper and flux. As soon as the tip is well bonded to the shank, that end is oil quenched. Final operation consists of the usual high speed steel temper at 1000-1050° F.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

ARMY E NAVY

MOLYBDIC OXIDE, BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company

50 [illegible] Avenue · New York City

MOLY

Publication Previews

SALES AND TECHNICAL LITERATURE

Send Request on Company Letterhead

A SMALL, compact catalogue describing their available products has just been issued by the PENINSULAR STEEL CO., Dept. J, 2222 Lakeside Ave., Cleveland, O. Clear and concise definitions of each type of steel and their heat treatment is given along with a hardness diagram and a discussion of hardening and drawing. **760-F**

FAST, ACCURATE INSPECTION OF small parts can be obtained with the Optical Contour Comparator described and illustrated in a 4-page leaflet issued by the FISH-SCHURMAN CORP., 236 E. 45 St., N. Y. C. This instrument employs optical projection of the contour of the part to be measured or compared and makes fast but detailed inspection of screw threads, dies, gears or parts for instruments, gauges, clocks and similar constructions. **761-F**

SPEED, ACCURACY AND APPLICABILITY describe PEC's production tools manufactured to individual specifications and described in Catalog No. 4 issued by PRODUCTS ENGINEERING CO., Dept. D, Los Angeles, Calif. Illustrations and diagrams of toggle clamps, drill guide pressure foot, drill jig bushings, inspection and locating pins, scribe line duplicators and other tools are shown. A leaflet describing and illustrating the new self-adjusting PEC jig clamp has also been issued by the company. **158-F**

SPECIFICATIONS AND PRICES of fastcut—high speed—combined drills and countersinks and woodruff keyseat cutters are presented in a single leaflet issued by the EMPIRE TOOL CO., Dept. T, 8774 Grinnell Ave., Detroit 13, Mich. **554-F**

"220 HAMMER BLOWS TO FORM A ⅝" DRILL" is an extensive operation, but of such importance in obtaining the greatest of structural refinement of steel in Ampco drills that hammer-forged Ampco drills carry this process to the highest limit obtainable in Tungsten (high speed) steel. This operation which leads to extremely low drilling costs and high tool efficiency is incorporated in Ampco tools without additional cost to the user as explained and illustrated in a 4-page leaflet issued by the AMPCO TWIST DRILL CO., Dept. J, Jackson, Mich. **762-F**

ADVANTAGES OFFERED IN air conditioning and industrial refrigeration are discussed in a 20-page bulletin issued by Westinghouse Electric & Mfg. Co., Dept. T, E. Pittsburgh, Pa. Included is a full page description of how air conditioning works. Outstanding features of Westinghouse Hermetically-sealed compressors are also described and illustrated. Four pages are devoted to the portrayal of working installations in a variety of war production plants. **35-F**

POWER hack saws, lathe chucks, dividing heads, magnetic chucks, demagnetizers and milling machine vises are described and illustrated in a 12-page bulletin recently issued by the L. W. CHUCK CO., Dept. T, Toledo, O. Their magnetic chucks are made in four sizes and are supplied with connections to operate on either 110 or 220 volt direct current. The demagnetizers are available in two models, for large and small work. A single pass over the stationary poles is sufficient to completely demagnetize the work affected. **763-F**

A NEW, SIMPLIFIED system for providing motor control for complex industrial processes is the G-E Cabinetrol discussed in a 24-page illustrated bulletin recently issued by the GENERAL ELECTRIC CO., Dept. D., Schenectady, N. Y. It describes how most control systems can be built up by combining standard control units and accessories into the required number of Cabinetrol sections. Another new G-E engineering development is the Amplidyne which harnesses the usually troublesome short circuit and puts it to work as described in an attractive new 36-page bulletin. G-E has also issued an illustrated 8-page bulletin describing Electronic Heaters for heating metals. It gives in detail the specifications of both the 5-kw and the 15-kw, 550-kilocycle electronic heaters. **77-F**

AN EXTREMELY attractive and well organized 65-page brochure on welding stainless steels has been issued by the ALLEGHENY LUDLUM STEEL CORP., Dept. J, Brackenridge, Pa. It interprets the techniques commercially employed and the precautions to be observed in the welding of stainless steel by the accepted processes. Full-color perspective drawings and diagrams of an unusual type illustrate the various methods used when stainless steel is welded. It is not only a practical instruction manual for the beginner in stainless steel welding, but its complete technical explanation will prove most helpful to production men, engineers, designers or metallurgists engaged in problems of stainless steel fabrication. **678-F**

INTENDED TO SPEED UP schedules and eliminate rejects are four basic heat-treating atmospheres—Endogas, Exogas, Monogas and Ammogas—described in a new booklet issued by WESTINGHOUSE ELECTRIC and MFG. CO., Dept. TJ, E. Pittsburgh, Pa. This new 16-page booklet, containing charts designed for quick selection of atmosphere and equipment, explains the chemical reaction, composition, cost, application and equipment needed for each atmosphere. These four basic atmospheres meet all requirements of annealing, brazing, hardening, tempering, gas carburizing, sintering and ammonia dissociator. **35-F**

ILLUSTRATIONS AND DESCRIPTIONS of Burro Cranes, Models 15 and 30, are presented in Bulletins F-100 and F-110 respectively, issued by the CULLEN-FRIESTEDT CO., 1316 S. Kilbourn Ave., Chicago, Ill. Mechanical details and diagrams of the full revolving burro crane mounted on a four wheel railroad truck are outlined in detail. **670-F**

PRESTITE, a ceramic plastic used for tube sockets and bases, thread guides, washers, bushings, brackets, cups and many other applications, is discussed and illustrated in an attractive 12-page brochure issued by the WESTINGHOUSE ELECTRIC & MANUFACTURING CO., Dept. TD, E. Pittsburgh, Pa. The manufacture, application, physical properties and design suggestions covering this molded porcelain are given. It is impervious to moisture, dense, strong, and combines the best characteristics of both wet and dry porcelain and can be glazed, ground accurately and cored. **35-F**

INCREASE PRODUCTION with quality finish at low cost with modern finishing machines suggests Bulletin No. 14 just released by the PACKER MACHINE CO., Dept. T, Meriden, Conn. Illustrations of Packer-Matic high production finishing machines which save thousands of man-hours due to their extreme flexibility are shown. A list of various operations and the type of machine needed to produce excellent finishing of numerous illustrated parts is presented. **764-F**

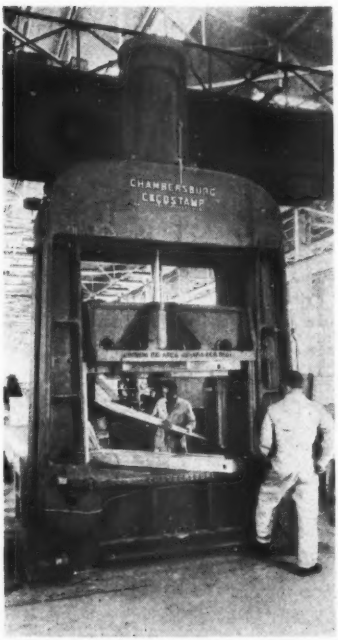
THE SPEEDMASTER Engineering Manual, No. 1203, recently revised, will be of use to those who are planning variable speed pulley installations in their present machines or those being planned for post-war use. Just released by THE SPEEDMASTER CO., 1208 Thacker St., Des Plaines, Ill., the manual fully describes the applications, engineering, installation and care of the Speedmaster along with a price list and specifications. **765-F**

CAPABLE OF withstanding constant shock loads—loads caused by rapid acceleration and deceleration, sudden stopping and braking, and rapid reversal of equipment rotating at high speeds—is the Denison HydrOILic Fluid Motor described and illustrated in Bulletin No. FM-200 issued by THE DENISON ENGINEERING CO., Dept. T, Columbus, O. These motors are readily adaptable to horizontal, vertical or angular mounting upon the equipment they drive. **260-F**

SPECIFICATIONS, PRICES and illustrations describing the various types of diamond tools manufactured by the CHAMPION DIAMOND CO., 556 Fifth Ave., N. Y. C., are presented in their new 4-page circular just off the press. "Champion" also carries a stock of unmounted diamonds and offers to submit parcels for examination. **766-F**

(Continued on Page 134)

THE CECOSTAMP SOLVES NEW METAL FORMING PROBLEMS



THE newer sheet metal forming problems posed by the needs of the aircraft industry included the need for a means of forming tougher, more elastic alloy sheets in clear-cut die impressions without tearing, wrinkling or reduction of section, to accurate limits without mismatching, and of speeding the production of these badly needed parts.

The Cecostamp was designed by Chambersburg to meet and solve these problems. How well it has done so is indicated by the fact that practically every aircraft manufacturer in the United States, and many of the most important ones in the countries of our Allies, are using Cecostamps for the production of alloy sheet metal parts.

And while wartime production is now absorbing all the Cecostamps that can be built, it is evident that their adaptability to peacetime production will disclose further possibilities of wider application.

CHAMBERSBURG ENGINEERING CO.
CHAMBERSBURG, PENNA.

CHAMBERSBURG
HAMMERS · CECOSTAMPS · PRESSES

(Continued from Page 132)

READING TO TEN-THOUSANDTHS of an inch becomes as easy as to one-thousandth with the clearly inscribed, accurate vernier of the new Reed Micrometer described and illustrated in an 8-page folder issued by the GEORGE SCHERR CO., INC., 128-B Lafayette St., N. Y. C. This new policy of producing 1, 2 and 3-inch micrometers with vernier reading to tenths only should prove of value to every mechanic. **490-F**

SAFETY-SECURITY-SIMPLICITY describes the National Safe-Line Wire Rope Clamp illustrated in a 4-page bulletin issued by the NATIONAL PRODUCTION CO., 4555 St. Jean Ave., Detroit 13, Mich. This new economical clamp can be set up in field or shop and no special tools are required. It prevents personal injury and eliminates splicing and servicing. **767-F**

DIRECT, INSTANT TWO-WAY communication between busy departments to coordinate executive control is one of the features of the Executone communication systems described and illustrated in a catalog-survey chart issued by EXECUTONE, INC., Dept. TD, 415 Lexington Ave., New York 17, N. Y. Housed in attractive walnut cabinets, six of the Standard Models from Executone's line of forty-six different units are shown. **668-F**

A CATALOG AND ENGINEERING MANUAL OF Cemented Carbide Tipped Tools has just been issued by the CARBIDE FABRICATORS CO., Dept. J, Royal Oak, Mich. Lathe tools, reamers, end mills, core drills, centers and special tools are detailed and illustrated. The engineering data includes trigonometric formulas, metric system conversion tables, decimal equivalents, tap drill sizes, diagrams and numerous tables. **769-F**

Amazing S-22 Synthetic

ETCHING STAMPS

Thousands of our new "S-22" Synthetic stamps now in service have proved that this new material outlasts rubber or other synthetics by from 3 to 4 times, when used with acid etching inks. Order "S-22" next time you need inspection stamps.

INSPECTOR'S KIT

Made of acid proof, non-critical material, this new Kit holds stamps, etching ink, ink pad and neutralizer. Inexpensive, compact and convenient. Write for quotation.

Write for Bulletin S--Catalog 146

This valuable bulletin illustrates the various styles of stamps available. Write for your copy today.

JAS. H. MATTHEWS & CO.

3896 Forbes Street Pittsburgh 13 Pa.

Branch Plants

New York, Boston, Chicago, Philadelphia, Newark, Syracuse

District Sales Offices

Cleveland Detroit Hartford Birmingham

SUPER-CUT new diamond bonded wheels are described and illustrated in a leaflet issued by INDUSTRIAL ABRASIVES, INC., Dept. T, 3724 W. 38th St., Chicago 32, Ill. Small, cup, plain and dish type wheels are shown along with drawings and specifications. **330-F**

22 SHORT STORIES OF HOW proper cutting fluids have solved production problems in war plants manufacturing products ranging from tanks to hypodermic syringes are featured in a 16-page booklet—"The 577th Oil"—just issued by D. A. STUART OIL CO., Dept. TDJ, 2727 S. Troy St., Chicago 23, Ill., manufacturers of industrial and automotive oils. It also contains other information on metal-working including tips on prolonging tool life, and a chart helpful in adapting sulpho-chlorinated oils to various metal-working operations, tools and metals. **613-F**

(Cont'd on P. 136)

Heat Treat Your Own Small Parts...

SAVE TIME AND MONEY THESE 5 DIFFERENT WAYS

This small compact electric furnace is inexpensive, handy and easy to operate—ideal for small tool and die shops—saves time these five different ways:

1. Eliminates delays in sending small machine parts out to overcrowded commercial heat treaters.
2. Saves time and expense of drawing or tempering small metal parts in large furnaces.
3. Cuts handling time when normalizing or annealing small parts. No waiting.
4. Conveniently available for pre-heating for subsequent high-speed hardening.
5. Eliminates shut downs and delays in servicing emergency repair orders.

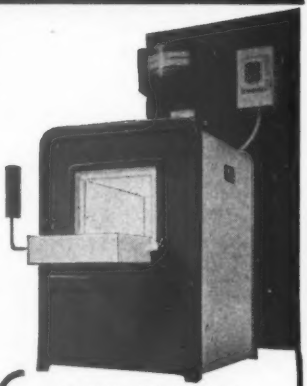
AVAILABLE IN TWO SIZES

Type	*Chamber Capacity*	*Amps 115 V*	*Watts*	*Amps 230 V*	*Price*
MH-3	8"W 6"H 14"L	29.6	3400	14.8	$124.00*
MH-4	10"W 6"H 18"L	....	4800	20.9	$191.00*

**Includes Hearth Plate*

MAX. SAFE TEMPERATURE—Continuous operation, 1750° F.; Intermittent operation, 1850° F.

AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire complete—$152.40.



REPLACEABLE HEATING ELEMENTS

Replaceable nickel chromium resistors embedded in rectangular refractory blocks. Elements form inner walls of furnace chamber, and may be replaced easily and quickly after removing rear panel — furnace structure remains undisturbed.

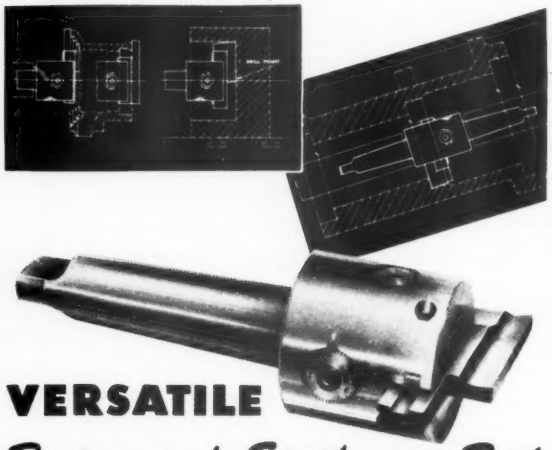
FREE—Complete data covering specifications, additional applications and ordering instructions are included in this new folder. Write for your copy today. Ask for Bulletin No. 50.

COOLEY ELECTRIC MANUFACTURING CORP.
32 SOUTH SHELBY STREET • INDIANAPOLIS 7, IND.

(Continued from Page 134)

AN EXTREMELY ATTRACTIVE catalog illustrating and describing the Metalmaster Lathe has been issued by THE BRADFORD MACHINE TOOL CO., Dept. TDJ, 657 Evans St., Cincinnati 4, Ohio. This model lathe is being made in three sizes only—12", 14" and 16" each of which has an actual swing 2½" greater than the rated size. Oil gages, push button station, three speed-change levers and leveling screws are a few of its outstanding features. A bulletin illustrating and describing the Bradford Cam Feed Drilling and Tapping Equipment is also available. **215-F**

A HIGHLY USEFUL BOOKLET just off the press, entitled "What Makes A Grease" has been issued by the SUN OIL CO., Dept. 28, 1608 Walnut St., Philadelphia 3, Pa. It briefly outlines the standards by which a good grease should be judged and points out the various factors which should influence the selection of the proper grease for a specific job. Also described are the outstanding characteristics of the various Sun Greases that have been developed for different uses—including Adhesive Pressure Grease, Gun Grease, Pressure System Grease, Roller Bearing Grease and Mine Lubricants. This authoritative little booklet will prove of value to any industrial engineer or production man interested in lubrication. **770-F**



VERSATILE

Boring and Spotfacing Tool

IN ADDITION to simplifying precision boring through the use of micrometer settings and making possible the facing of surfaces flat and square with holes, this unique B & B Tool brings you many other advantages.

It can be used for inverted boring and back spotfacing; it will bore and face many diameters at one time with a stepped blade; it presents a definite advantage in boring blind holes; and is a decided asset for use in boring long holes.

It will enable you to produce more accurate work with fewer motions in much less time. Users consider it one of the most valuable tools in their tool rooms.

The many sizes of standard blades available provide an exceptionally wide range of cutting widths.

BUY WAR BONDS

BOKUM TOOL CO.

14775 WILDEMERE AVE. · DETROIT 21, MICH.

SOLID ROUND AND SOLID SQUARE Kennametal tools for precision boring are featured in Catalog 43C issued by KENNAMETAL INC., 500 Lloyd Ave., Latrobe, Pa. Substantial price reductions have been made in standard tools and standard blanks. Suggestions on the care and grinding of Kennametal tools are concisely presented. **33-F**

THE NEW AMPAC "400" A-C welder is described and illustrated in a 4 page bulletin, B-6302, released by ALLIS-CHALMERSS MFG. CO., Dept. T, Milwaukee, Wis. A pictorial section shows for the first time the step-by-step construction and internal assembly of a continuously variable heavy duty A-C welder. Complete electrical performance data on this unit at all loads is also given. **183-F**

THE COMPLETE STANDARD LINE of Lyon-Raymond Material Handling Equipment is described and illustrated in Circular 134 issued by the LYON-RAYMOND CORP., 1406 Madison St., Greene, N. Y. All units shown elevate hydraulically through hand, foot-operated or motor-driven hydraulic pumps which have the best performance qualities under either light or heavy loads. **374-F**

(Cont'd on P. 138)

FOR WANT OF A HORSESHOE NAIL A KINGDOM WAS LOST!
FOR WANT OF ONE SMALL SPECIAL WASHER A CRITICAL ASSEMBLY COULD NOT BE SHIPPED TO OUR ARMED FORCES!

That Explains THE IMPORTANCE OF

HOVIS UNIVERSAL MASTER WASHER DIES

BY USING the Hovis method you can make any size washers you need on short notice. In this way you avoid costly and serious delays. The HOVIS system offers you many advantages; for instance, you eliminate all process engineering — all tool designing — all tool making — and all tool tryout. There are four sizes of Hovis Universal Master Washer Dies. Each die is complete in itself, made on an all steel precision standard die set and is provided with stock gauges and stops. Having once made a moderate investment in Master Dies in sizes to fit your needs, FIVE SMALL INTERCHANGEABLE PARTS are all that is necessary to make any size washer.

Write for Folder

Made in 4 sizes:
¾"—1½"—2½"—4".

HOVIS SCREWLOCK COMPANY

8100 E. NINE MILE ROAD — VAN DYKE, MICHIGAN
Suburb of Detroit Phone: Centerline 1575

(Continued from Page 136)

SPECIAL machines built for the purposes of molding, bending, broaching, two-way drilling, piercing, spot facing and flame hardening are discussed and illustrated in two new bulletins just released by HYDRAULIC MACHINERY INC., 12830 Ford Rd., Dearborn, Mich. Bulletin SM 843 describes different models of flame hardening and special machinery and PT 845 describes several models of hydraulic presses. Most of the operations are sequenced and are powered by standard "HY-MAC" Power Units. In addition to conventional vertical "HY-MAC" hydraulic presses, a floor-level and arbor press model are described. **32-F**

THE NECESSITY OF second tapping to insure perfect threading is eliminated by the exclusive patented Bakewell features described and illustrated in a new catalog issued by the BAKEWELL MFG. CO., 2012 Santa Fe Ave., Los Angeles, Calif. The Bakewell No 1-R Radial Tapping Machine, described, is built for tapping extra large and bulky pieces of work, particularly where it is more advantageous to move the tap to the work rather than the work to the tap. **200-F**

"THE WORLD OF TOMORROW will be welded by a paint brush" according to a 12-page booklet describing Reanite, issued by U. S. STONEWARE, Dept. H, Akron, O. The Reanite Bonding Process is effective for uniting metal to metal, or rubber, synthetic rubber, plastics, leather or wood to metal, or to each other. It is a one-coat process—simple and easy in application—and remains effective through a temperature range extending from 50° F to as high as 300° F. **771-F**

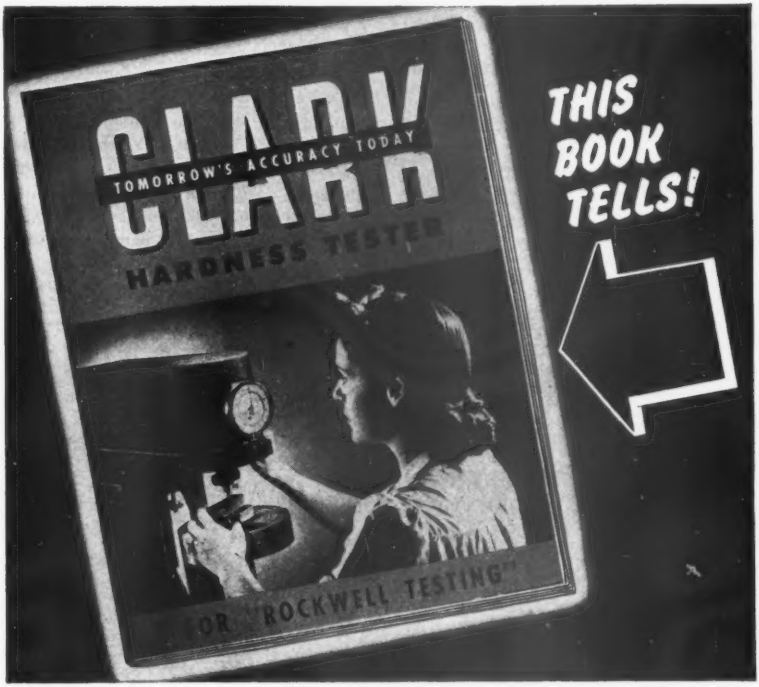
"HYPER-MILLING", a new method for the face-milling of steel with Firthite-tipped cutters, is portrayed in Engineering Bulletin No. FE-106 issued by FIRTH-STERLING STEEL CO., Dept. TDJ, McKeesport, Pa. It is performed at extraordinarily high cutting speeds; permits the milling of heat-treated alloy steels; produces highly burnished surfaces; and results in a high production rate. The Hyper-Milling Principle is believed adaptable to many additional types of milling other than face-milling, such as slotting, straddle-milling and profiling. **431-F**

LATHES AND ACCESSORIES are described and illustrated in a booklet issued by the LOGAN ENGINEERING CO., 4907 Lawrence Ave., Chicago, Ill. Specifications of their turret lathe, hand screw machine, bench model, and floor model back geared screw cutting lathes and quick change gear lathe with automatic apron are presented. **2-F**

(Cont'd on P. 140)

DO YOU KNOW THE TRUTH

About Hardness Testing?



The new Clark catalog is more than a catalog.

It is a 20-page reference manual on the history, theory, practice, and equipment for modern, scientific hardness testing. Printed in two colors, 8½" x 11", it is available without charge to manufacturing executives. Just drop a line on your letterhead to Department TD, CLARK INSTRUMENT INC., 10200 Ford Road, Dearborn, Mich.

CLARK
TOMORROW'S ACCURACY TODAY
HARDNESS TESTER

(Continued from Page 138)

"CHISEL POINT Diamonds for Radius Dressing outwear pin point diamonds 50 to 1" states a pamphlet recently issued by the SOMERSET INDUSTRIAL DIAMOND CO., 220 Virginia St., Hillside, N. J. Different style diamonds for such machines as the Heald, Landis, Norton, Cincinnati Centerless and others are illustrated. Another pamphlet issued by the company describes the Somerset Radius Dresser which features a dust-proof bearing. **614-F**

A COMPLETE LINE of heavy-duty lathes is described and illustrated in a catalog published by THE BOYE & EMMES MACHINE TOOL CO., Dept. D, Caldwell Dr., Cincinnati, O. Specifications of the entire line of fourteen through thirty-six inch lathes are included. **214-F**

GAERTNER MEASURING MICROSCOPES and many other precision instruments for industrial and scientific laboratory applications are fully described and illustrated in a 64-page catalog issued by the GAERTNER SCIENTIFIC CORPORATION, 1201 Wrightwood Avenue, Chicago, Illinois. Included as a supplement is their Bulletin 147-14 detailing by text and diagram the new GAERTNER Toolmaker Microscope. Many pages are devoted to measuring microscopes, comparator microscopes, optical levers, reading telescopes, and both linear and circular dividing machines. **779-F**

The Mark of Quality

SWANSON
TOOL AND MACHINE CORPORATION, ERIE, PA.

Since 1919

SCRAPED SURFACE PLATES

MADE IN 24 DIFFERENT SIZES UP TO 36" x 60"

- Properly designed.
- Made from proven material, properly stabilized to prevent distortion and to outwear ordinary iron.
- Made to the most exacting standards that insure the highest degree of accuracy obtainable in any plate.
- More bearing per square inch for less cost.

"You Can't Buy a Better Surface Plate"

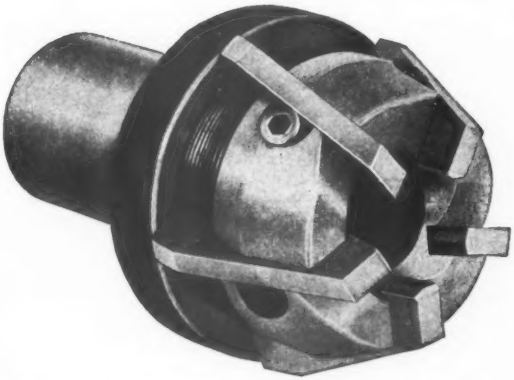
SWANSON TOOL & MACHINE CORPORATION
818 EAST EIGHTH STREET • ERIE, PENNSYLVANIA

PRECISION GROUND aviation type universal joints are featured in the 1944 catalog just released by the DIX MANUFACTURING CO., Dept. TDJ, 603 E. 55th St., Los Angeles 11, Calif. This profusely illustrated 24-page booklet includes illustrations of their specially designed precision machines for split-thousandths manufacture and various types of Dix joints for special requirements. Condensed information regarding special accessories for increasing lathe production—the Dix-Wilder Multiple Carriage Stop and the Dix-Wilder Automatic Collet Closer is included. This should be of interest to the designer, engineer, purchasing agent and others who have use for universal joints. **784-F**

"THE CONTROL OF INDUSTRIAL DUST" is the title of an attractive and interesting 30-page booklet issued by the PANGBORN CORP., Dept. TDJ, Hagerstown, Md. Outstanding features of the "CH" system of control are covered and il-

(Cont'd on P. 142)

GENESEE ADJUSTABLE HOLLOW MILLS



(Style H Facing & Counterboring Tool)

Cut Cost—Increase Production

with GENESEE inserted blade—
ADJUSTABLE HOLLOW MILLS
FACING & COUNTERBORING TOOLS
SPECIAL PRODUCTION TOOLS

Backed by 35 years experience our Engineering Department is always ready to serve you in your Production Tool problems.

◆

Write for complete Catalog No. 42-H

GENESEE
Manufacturing Co., Inc.
Rochester 4, N. Y.

(Continued from Page 140)

lustrated along with diagrams showing how the system works and standard sizes and dimensions. This book which "took 35 years to write" and takes approximately an hour to read explains why dust should be controlled and how it is controlled by the world's largest builder of dust collection and abrasive blast cleaning equipment. **422-F**

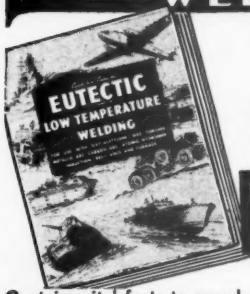
A PRECISION MACHINE TOOL vise for angular milling, grinding and drilling describes the Wesson Universal Vise illustrated in a 4-page bulletin issued by the WESSON PRODUCTS CO., 714 Fisher Bldg., Detroit, Mich. This vise saves set-up time on all angular operations and insures accurate angles. **710-F**

A CONDENSED 32-page illustrated catalog describing the entire line of Gisholt products, including turret lathes, automatic lathes and balancing machines, has just been published by the GISHOLT MACHINE CO., 1199 E. Washington Ave., Madison, Wis. Special machines developed to meet specific and unusual tooling problems of individual manufacturers are detailed and various interior plant views are shown. **303-F**

CONVERSION OF tools from one design to another entirely by grinding is explained and illustrated in a 16-page booklet issued by the NATIONAL TOOL SALVAGE CO., 6511 Epworth Blvd., Detroit 10, Mich. Shell end mills made from worn out thread mills and angular cutters made from plain mills are shown. Plain mills can be recut to original tooth design or changed into side mills, either regular or staggered. **772-F.**

Castolin Eutectic

EUTECTIC*
(Means Lowest Binding Alloy)
LOW TEMPERATURE WELDING



FREE LATEST
WELDING DATA BOOK

Contains the Answers to Hundreds of Wartime Welding Problems

Contains vital facts to speed up your production and cut your welding costs with Eutectic Low Temperature Welding. Also valuable information on:

Production Welding
Joining dissimilar metals and dissimilar gauges without burning • Design simplification • Substitution of butt joints for lap joints, etc.

Salvaging Defective Castings
Effectively at low cost • Completely machinable, invisible welds • Ideal for thin walled or heavy castings in all metals.

Tool Salvaging
"Hard-to-get" tools costing up to $180 and requiring up to 50 weeks for delivery, salvaged for re-use in a few minutes at a cost of but a few cents.

* Reg. U. S. Pat. Off.

Write for Welding Data Book V

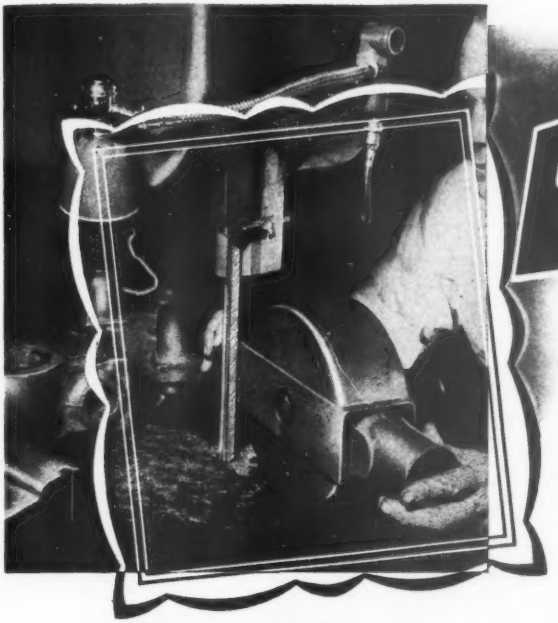
EUTECTIC
WELDING ALLOYS COMPANY
Originators of the Low Temperature Welding Process
40 WORTH STREET, NEW YORK, 13, N.Y.

GOVERNMENT SPECIFICATIONS for stainless steels are shown on the Frasse Data Chart, Section A, No. 2, distributed by PETER A. FRASSE & CO., INC., 23 Grand St., N. Y. 13, N. Y. Nearest corresponding A.I.S.I. type numbers are shown along with Army, Navy and Federal specifications. **781-F**

THE NORTON UNIVERSAL MULTIPURPOSE GRINDER finds its particular field of utility in miscellaneous, small-lot general production or in tool room work. Its standard equipment gives it a versatility to handle a variety of work without difficulty of set-up or wastage of production time. In a bulletin just issued by the NORTON CO., Dept. TDJ, Worcester 6, Mass., there are illustrations of grinding set-ups ranging from tool work, grinding of thrust bearings, and aircraft parts, to a combination shoulder and cylindrical grind with the work held on a face chuck.

The possible angular arrangements of the

(Cont'd on P. 144)



GOOD ENOUGH TO FRAME

★ Because it's the kind of job every metal worker likes to turn out.

Only 17.7 minutes were required to file these two irregular shaped, annealed steel castings after the gates and risers had been removed by sawing. Time of former method was materially cut down and the finish was much smoother.

A ½" flat, medium coarse DoALL File was used at a velocity of 125 ft. per minute.

DoALL BAND FILES

Turn out scores of triumphs in filing because they are so expertly designed and made in the correct variety of cuts, widths and styles, to tackle any kind and shape of metal, alloy, plastic, composition or laminated material.

Refer to the DoALL File Job Selector and you'll know instantly the proper file and speed to use for each job. Yes, it's as easy as that.

A CLINIC FOR HARD JOBS — Free to industry — the DoALL Laboratory with the most modern equipment, manned by engineers who know filing. Send your problems and receive written report of findings and recommendations that may save you many man-hours, much time and materials.

You'll find our literature interesting. Let us send it to you.

DoALL

SALES OFFICES IN PRINCIPAL CITIES

BAND FILES *Products of the* **DoALL COMPANY**

Address inquiries to: 1205 Thacker Street, Des Plaines, Illinois

INDUSTRY'S NEW SET OF TOOLS SOLD AND SERVICED BY 34 DoALL OFFICES

(Continued from Page 142)

headstock, wheel slide and flat-topped table assist in quickly and easily obtaining otherwise difficult set-ups. Five "close up" illustrations plainly detail outstanding constructional features of the "Type C" which is available in swings of 12", 14" and 16" and lengths of 36", 48" and 72". **545-F**

A HELPFUL GUIDE to aid all lift truck operators has just been published by the TOW-MOTOR CORP., 1231 E. 152nd St., Cleveland 10, O. This 24-page booklet emphasizes by simple illustrations typical load-carrying devices and methods of stacking. Operating instructions in simplified form are given for starting, shifting gears, steering, lifting and tilting. **495-F**

ATTRACTIVELY PRESENTED is Bulletin C-1 of 28 pages describing and picturing overhead handling equipment and installations manufactured by THE AMERICAN MONO-RAIL CO., 13131 Athens Ave., Cleveland 7, O. Photographs depict the use of this equipment in aircraft, automotive, ceramic, chemical, food, laundry, machine shop, metal working, paper, shipping, steel, wire, textile and other industries. The engineering information presented in this publication is of value to industrial executives and engineers who deal with problems of material handling. **566-F**

ROTARY SURFACE GRINDERS are described and pictured in a folder containing bulletins descriptive of the entire line of grinding machines manufactured by the ARTER GRINDING MACHINE CO., 15 Sagamore Rd., Worcester, Mass. Three models of their machines now offered, "A", "B", and "C", give chuck capacities of from 8" to 40". **22-F**

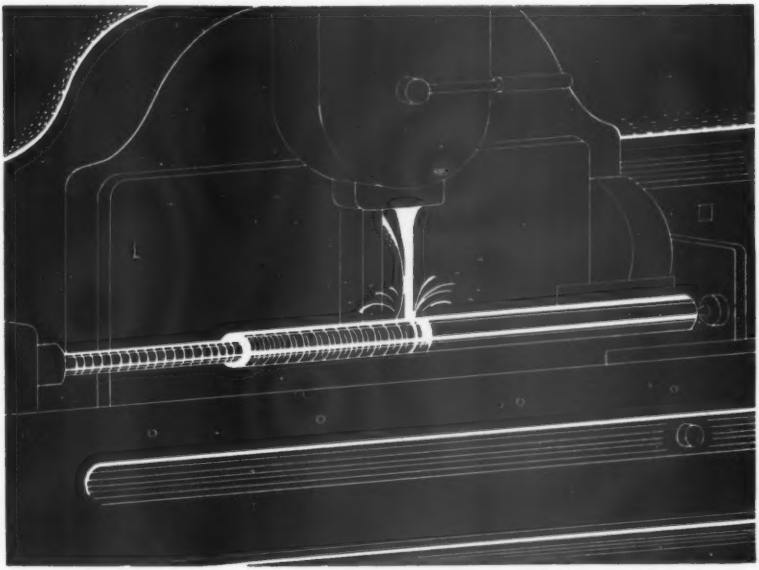
Flame Hardening · Annealing · Aerocasing
Bar Stock Treating and Straightening
Heat Treating · Pack or Gas Carburizing
Sand Blasting · Chapmanizing · Tempering
Cyaniding · Nitriding · Hi-Speed Hardening
Physical, Tensile and Bend Tests

THE LAKESIDE STEEL IMPROVEMENT CO.
5418 Lakeside Avenue CLEVELAND, OHIO Phone Henderson 9100

THE COLOR TELLS the thickness of Artus Plastic Arbor Spacers pictured in a leaflet recently issued by INDUSTRIAL PRODUCTS SUPPLIERS, Dept. TDJ, 2 Broadway, N. Y. 4, N. Y. These plastic spacers retain their thickness and evenness under all normal conditions and thus allow the assembly of gangs of cutters, slitting saws, or pairs of gears, to spacing accuracies within 1/2000th of an inch. Also issued by the company is a leaflet describing Metocraft Soft Alloy Hammers which are shaped to fit the hand and shock absorbent. **594-F**

INFORMATION ON Newark Woven Wire Screen and Wire Cloth Products is contained in a 116-page handbook, catalog C, issued by the NEWARK WIRE CLOTH CO., 359-369 Verona Ave., Newark, N. J. Complete and concise information on their wide range of wire cloth products; a glossary of terms; instructions on how to compute mesh, space, open area; illus-

(Cont'd on P. 146)



GILRON THREAD GRINDING COOLANTS ARE TAILOR MADE!

Aircraft parts, standard and special gages and a myriad of precision specialties to fill our war needs require thread grinding operations.

Gilron engineers have developed an oil (coolant) to materially increase production speed and output of inspector-approved work.

As a tailor-made product it is adjusted to meet the working conditions of each plant according to material ground, finish, grinder and desired speed and feed.

A convincing list of satisfied users testifies to the value of this *new* Gilron development. It will pay you to investigate. Write for data unit T.

Gilron PRODUCTS COMPANY

1557 EAST 40th STREET
CLEVELAND, OHIO

SCIENTIFIC COOLANTS
DRAWING-GRINDING-CUTTING

(Continued from Page 144)

trations of weaves; and a section on selecting, ordering and testing are included. This handbook contains much useful information for the practical buyer of wire cloth and other woven wire products. **780-F**

MARKING SIZE. part or operation numbers, owners or manufacturers names and identification data, and other information susceptible of application by a "free hand" method can be done as simply as writing with a pencil. Nothing is required but the Etchograph which is available in three models. The Baby Grand model is the smallest device, is easily portable and is intended for tool room work. The Standard model will handle anything that is markable, including the hard alloys such as Stellite and Carboloy. The Junior model will mark small fine instruments, as well as larger tools such as carbon or high speed cutters and drills, and also good size jigs, fixtures, dies, masters and similar pieces. Further information may be had by writing the BREWSTER-SQUIRES CO., 44 Church St., N. Y. C. **576-F**

PRODUCTION TOOLS such as friction chucks, positive drive chucks, collets, floating tap sleeves, stud setters, universal joints, aircraft universal joints and wrenches are described and shown in Catalog No. 14 issued by THE APEX MACHINE & TOOL CO., Dept. T, Dayton, O. Catalog No. 17 describes Power Bits and Hand Drivers for Clutch Head Type A Screws. As Clutch Head Bits are made to allow several grindings, the life is greatly prolonged. Catalog No. 15 covers Power Bits and Hand Drivers for Phillips Recessed Head Screws. Specifications on Insert Type Power Bits and Hand Drivers for Phillips Recessed Head Screws are presented in Bulletin 102. Information on Adjustable Stud Setters is contained in Bulletin 101. Their ruggedness makes them desirable tools for either hand or power operations. **192-F**

BLOWS CUSHIONED

with

Rawhide

HAMMERS and MALLETS

Coiled Rawhide faces strike effective blows without marring or battering; speed up work; reduce spoilage. Hold true faces—strike accurately. Outlast several ordinary mallets. Reduce bounce and recoil—prevent fatigue. All sizes with light or weighted heads. Write for Catalog.

Replacement insert faces for C/R Hammers sold by leading supply houses.

CHICAGO *Rawhide* MFG. CO.

1280 ELSTON AVE. ★ CHICAGO, ILLINOIS.

THE PROFILOMETER—a production inspection instrument used for measuring average surface roughness in microinch units is described and illustrated in an 8-page booklet recently issued by the PHYSICISTS RESEARCH CO., Dept. 9, Ann Arbor, Mich. The subject of surface roughness is discussed in detail and is worthwhile reading. **773-F**

"MAKE SPRINGS IN A JIFFY" with the Blaner Universal Hand Spring Winder suggests a leaflet issued by THE JOHN BLANER CO., 634 Meek St., P. O. Box 163, Sharon, Pa. Instructions for using the hand spring winder, designed for home, model development and experimental workshops, are clearly explained. **598-F**

ENGINEERED VENTILATION FOR INDUSTRY is outlined and illustrated in an 8-page con-

(Cont'd on P. 148)

Tool sharpening is *simpler, easier, cheaper, and extremely accurate* .. with the new

Delta Tool and Cutter Grinder

Here is the latest development in Tool & Cutter Grinder design, combining the best features of units of this kind — and its low cost permits its use in all types of shops where accurate grinding must be done.

The new Tool & Cutter Grinder attachment has been added to the famous Delta Toolmaker Surface Grinder (machine may also be used as a surface grinder).

Almost any conceivable angle can be ground. Delta construction features assure perfect alignment and freedom from play, for extreme accuracy over a long, useful life. The machine itself is substantially built (weight over 700 lbs.) and machined to very close tolerances.

For a real find that gives creditable results for years, investigate the modern, goodlooking, efficient machine. Consult your Delta industrial distributor (Delta sells only through distributors) or write for new bulletin.

M6CC

Specifications

Wheels must have 1¼" hole.
Table surface 5¾ x 13".
Traverse feed, one graduation is .001".
Maximum vertical adjustment of wheel by means of micrometer is ⅜", each graduation is .0005".
Spindle speeds with a 60 cy 1750 R.P.M. motor are 3200 and 4200 R.P.M.

Price f.o.b. Milwaukee without wheels, motor, or switch.. $370.00

Priority required, A-1-A or better, under Restrictions of Limitations Order L-237.

DELTA
MILWAUKEE
Machine Tools

TEAR OUT AND MAIL COUPON TODAY!

THE DELTA MANUFACTURING CO., 612N E. Vienna Ave., Milwaukee 1, Wis.
Please send me your new catalog giving full details on the new Delta Tool & Cutter Grinder and your full line of low-cost machine tools.

Name_____Position_____
Company_____
Address_____
City_____(____) State_____

(Continued from Page 146)

densed catalog, No. 431, issued by THE ALLEN CORP., 9758 Erwin Ave., Detroit 13, Mich. Their standard practice procedure in ventilation involving moisture, heat, fume and dust removal is presented along with specifications and illustrations of different types of fans and turbine ventilators. **181-F**

PRECISION INSTRUMENTS—analyzers, indicators and recorders—for precise measurements in power plants, the process industries and in laboratories, are described and illustrated in a 4-page pamphlet released by CAMBRIDGE INSTRUMENT CO., INC., 3737 Grand Central Terminal, N. Y. C. The Cambridge Recording Gas Analyzers can be applied in the manufacture of steel, cement, explosives, paper, rubber, chemicals, and in oil refineries and other process industries. Also shown are applications in power plants, heat treating furnaces and fruit storage facilities. **774-F**

"AN INTRODUCTION TO PLUSWOOD", a high density wood alloy, is the title of a 6-page bulletin released by PLUSWOOD, INC., Dept. TDJ, Oshkosh, Wis. This new "wood alloy" is comparable to metal, and metal working tools are needed to handle it. It can be sawed, drilled, turned, threaded, milled and tapped, and is highly resistant to decay. **775-F**

A NEW TYPE GRINDER—the Swing Frame Abrasive Belt Machine—has invaded the field of solid grinding wheels, once thought to be the only proper tools for all heavy metal grinding operations. Equipped with Heavy Duty Metalite Cloth Belts, designed especially for Swing Frame use, these machines are making new grinding history as described and illustrated in a 4-page pamphlet issued by the BEHR-MANNING CORP., Dept. D, Troy, N. Y. **110-F**

PRECISION TOOL ROOM AND PRODUCTION LATHES

Best known as quality tool room lathes, SHELDON Precision Lathes are also ideally suited for much second operation and other production work because of their extra collet capacity, sturdy construction, accuracy and available production features including: Lever operated Bed Turret, or Tool Post Turrets, Lever operated Collet Attachments, Tailstocks, Double Tool Posts, 4-speed underneath motor drives, etc. If you are looking for a 10", 11" or 12" Precision Lathe for the Tool Room or Production Line, be sure to see the SHELDON Lathe before you order.

SHELDON MACHINE COMPANY, INC.
4236 N. Knox Ave. CHICAGO 41, U.S.A.

SPEEDS SMALL-PARTS CLEANING—The Aeroil Twin Dipmaster, Model 2EC, containing two hot liquid dip tanks in one unit is described and pictured in leaflet No. 511 issued by AEROIL BURNER CO., INC., Dept. T, West New York, N. J. This portable, electrically heated and insulated machine is ideal for preparing metal for lacquering, plating, galvanizing, enameling, painting, stripping, heat-treating and many other uses. **776-F**

DRIVES AND SPEED REDUCERS are detailed in an illustrated 4-page broadside entitled "Cleveland," just released by THE CLEVELAND WORM & GEAR CO., 3282 E. 80th St., Cleveland 4, O. From the diversified group of Standard Units shown the design engineer can quickly select the suitable reducer equipment for the great majority of

(Cont'd on P. 150)

Multiplies THE USES OF STANDARD TOOLS

You can make standard machine tools perform many "extra" functions . . . multiply the usefulness of these machines . . . do simple or compound angle drilling, milling, grinding, key-slotting, die sinking, reaming and many other difficult precision angle machining operations . . . with WESSON Universal Vises. They slash *hours* off your set-up and tool-up time! Extreme rigidity . . . freedom from "chatter" . . . permits high precision at high speed! Compact . . . *lower height than any other Universal Vise* . . . works in closest quarters. Boost production on your present equipment with WESSON Vises!

Less **SET-UP TIME**

Greater **PRECISION**

AVAILABLE NOW

IMMEDIATE DELIVERIES

WESSON
Universal **VISES**
BUILT TO WESSON STANDARDS OF QUALITY AND PRECISION

WESSON CO.,
Detroit, Michigan
(Ferndale Station)

Please send me illustrated bulletin of WESSON Universal VISES and ANGLE PLATES.

Name and Title.....

Firm Name.....

Address.....City & State.....

(Continued from Page 148)

his installations. These units are precision-built for continuous heavy duty and are available in any size or ratio. **777-F**

A NEW CATALOG detailing and illustrating the Libby Type "H" Heavy Duty Turret Lathes has been issued by INTERNATIONAL MACHINE TOOL CORP., Libby Div., Dept. T, Indianapolis, Ind. Information on the Fixed and Sliding Bed type Turret Lathes and special Heavy Duty Turret Lathes is also included. **87-F**

PARTICULARLY TOUGH AND RESILIENT so as to not mar the struck surface is the new line of Plastic Face Hammers and Plastic Mallets manufactured by GREENE, TWEED & CO., Dept. TDJ, 4377 Bronx Blvd., N. Y. 66, N. Y. The hammer grip and perfect balance combine to minimize fatigue and the special plastic prevents transmission of impact shock to the worker. Further information on these tools can be obtained by writing to the manufacturer. **782-F**

"BODY FLO" Magnetic Chucks are featured in an attractive 4-page bulletin issued by MAGNETIC HOLDING DEVICES, INC., (formerly Anderson & Brown Co.), 2034 E. 22nd St., Cleveland 15, O. "Body Flo" is a new low voltage, magnetic technique for holding work. It is claimed to be so powerful that it may be used for holding work on planers, shapers, grinders and other machines. A special feature of this Magnetic Chuck is that the work is demagnetized as it is released from the holding operation. **783-F**

INFORMATION ON analyses, applications, manufacture, fabrication, styles of heads and standard size of sheets and plates is included in a new catalog describing Jessop Stainless-Clad Steel just released by the JESSOP STEEL CO., Dept. TDJ, Washington, Pa. The sections on deep drawing, grinding, polishing, cleaning, gas-cutting, riveting, soldering, welding, etc., will be of interest and value to fabricators investigating the use of this composite metal. **259-F**

PRODUCTION AIDS to modern methods in material handling are described and illustrated in Catalog 184 issued by ALL-STEEL-EQUIP CO., INC., Dept. T, Aurora, Ill. The wide line of products pictured throughout 16 pages offers a single source of supply for shop equipment such as steel stacking, shop and tool boxes, tool stands and handlers, bench drawers, drill and reamer cabinets and racks and tapered pans. **184-F**

SMALL TOOLS for watch and instrument workers are shown in the 132-page catalog of HENRY PAULSON & CO., 37 So. Wabash Ave., Chicago 3, Ill. **778-F**

How to TRAIN Tool Makers FASTER!

● Widely used throughout industry and trade schools, "Tool Steel Simplified" meets the urgent need for a complete, up-to-date text for training new men, "refreshing" older men, or trouble shooting in the tool room. Tells in easy shop language how to select tool steel, how to make tools, how to improve tool performance. It is available *at cost*, $1.00 per copy, to tool steel users in the U. S. A.

TOOL STEEL SIMPLIFIED

By FRANK R. PALMER
Vice-President of
The Carpenter Steel Company
315 Pages *205 Illustrations*
$1.00 *Postpaid in U.S.A.*
Elsewhere $3.50

MAIL TODAY

THE CARPENTER STEEL COMPANY
Reading, Pa. Dept. 9D

Please send me postpaid a copy of "Tool Steel Simplified." I enclose $1.00 *(*$3.50 *outside the U. S. A.) in full payment for the book.*

Name_____ Title_____

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Mailing Address_____

City_____ State_____

Airplane Engine Parts accurately honed to a super-smooth finish.

"Produced an extremely accurate and glass-like finish."

Aircraft Valve Tappet Roller. 4-Micro finish.

You can handle jobs like these faster, more accurately—at lower cost with the

SUNNEN PRECISION HONING MACHINE

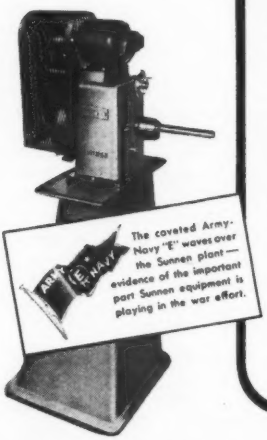
Hones and finishes internal cylindrical surfaces from .185" to 2.625" in diameter—with a guaranteed accuracy of .0001". Produces a super-smooth finish of 2 to 3 micro inches.

Does not require skilled labor—in many plants girls in 'teens are handling jobs in tenths.

No jigs or fixtures needed—work is held in hands. Relieves big internal grinders for other jobs.

Low in cost, economical to operate. Fast—can be "set up" for any size in its range in less than a minute.

Let a Sunnen engineer check your job in your plant with this equipment—or write for bulletin giving complete information.



The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

Carburetor Idler Valve Jet. Hole is honed after reaming for smooth action.

Cast Iron Valve Stem Guide. ½ to one thousandth removed—220 pieces per hour. Better finish and straighter hole.

Roller Bearing Outer Race. Finish improved from 12 micro inches to 2 micro inches.

Idle Control Valve Seat. Due to large "windows," almost impossible to get straight round hole by grinding. Sunnen solved the problem.

Bearing. A very small part. 2 micro inch finish necessary.

Hydraulic Valve. Previous method of grinding threw radius on edge of "windows." Sunnen honing eliminated trouble.

Aircraft Valve Tappet Roller. Honed after grinding to give 100% bearing surface.

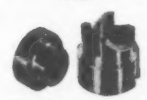
Hydraulic Metering Valve Stem. Hole .156" in diameter; reamed, heat treated, and then honed. Honing 3 times as fast as previous method.

Wing Bracket. Two ½" holes must be in line. Honing increased bearing surface and reamer life.

Stainless Steel Load Compensator Valve Seat. Hole is honed to .0002" limit.

Aircraft Hydraulic Brake Cylinder. Honing three times faster than lapping—and gave a straighter hole.

Hydraulic Two-Way Control Valve. Hole is honed to eliminate leakage.



Aircraft Instrument Panel Control Wire Bushing. Hole .187" diameter—held to .0002", stock removal .001", sixty per hour.

Counterbore Cutter. Very small part and because of this fact hard to handle by any other method.

Pump Shaft Bushing. Bronze; honing follows reaming. Sunnen method greatly reduced valve leakage.

Calculator Machine Gears. Cut from hole which is reamed and then honed. Honing maintains same pitch line concentricity.

Aircraft Valve Guide. Valve tappet roller pin hole honed to 6 micro inch finish.

Header Die. Life of header dies increased 3 to 9 times over lapping. Knock out pin breakage practically eliminated.

Carburetor Metering Jet. Two black bushings Bakelite. Line honing by Sunnen method.

Spur Gear. By honing gears direct from heat treatment, concentricity of pitch line is maintained.

SUNNEN

SUNNEN PRODUCTS COMPANY, 7947 Manchester Avenue, St. Louis, Mo.

Canadian Factory, Chatham, Ontario

Scherr Comparitol Gear Tester Both Compact and Accurate

AFTER months of careful research, the George Scherr Co. of New York City has developed the Scherr Comparitol Gear Tester for inspecting precision gears. This instrument serves the purpose of detecting and locating faults during the manufacturing process and is also used to check the accuracy of gears when completed.

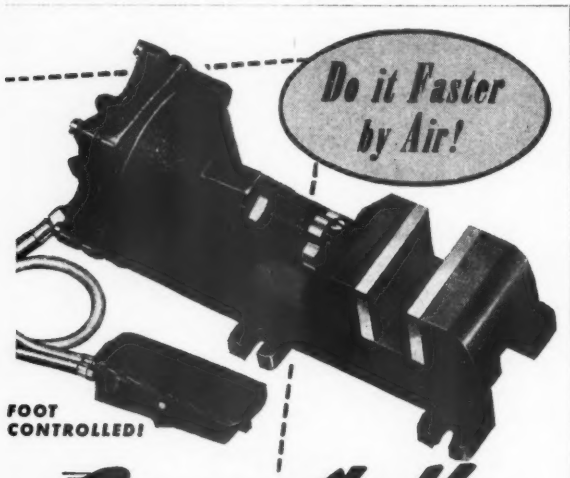
Being of vertical construction, the Gear Tester occupies little bench space and may be readily transported. It employs the Comparitol head mechanism widely used for years on the standard type Comparitol. This mechanism enables the inspector to quickly and accurately detect gear faults. By setting up the instrument to the proper distance with gage blocks or standards, the center distance may be quickly checked.

The master gear is placed on an arbor and the gear to be tested is placed on another arbor directly in contact with the master. The master gear bracket is provided with a counter-balance which can be adjusted so that the pressure between master gear and gear to be tested is always uniform. The gears are rotated by a handle with pinion located beneath the gear under inspection.

Any divergence or error is quickly shown in the Comparitol head which reads to .001", .0005", .0025" or .0001" as desired. The Comparitol Gear Tester will show up rolling action between two working gears or gear and pinion. It shows up eccentricity of gears, if any is present, and makes any variation in tooth thickness readily discernible. The instrument may also be employed to check gear train assembly quickly, giving indication of run-out which may have been caused by faulty assembly of gears.

The Comparitol Gear Tester has a standard range of 1" to 6" center distance with special attachments available to enable the inspector to check down to still shorter center distances.

George Scherr Co., 128-B Lafayette St., New York, N. Y., will send complete details of the Comparitol Gear Tester on request. 490-F.



SPEEDY AIR VISE

GRIPPING FORCE 15 TIMES AIR LINE PRESSURE

• Speedy Air Vise helps workers get out more and better work—in less time! Foot control valve opens and shuts vise instantly, leaving *both* hands free to produce. Operates from air line or individual compressor, exerting a grip of 15 times air line pressure. Jaw opens up to 3 inches, easily fitted to hold castings, parts, jigs. etc. Speeds up every drilling, light milling, tapping and assembly operation. Compact, sturdy, trouble-free, low in cost! »»»»» *Speedy Air Vise, complete with Foot Control Valve, Air Hose and Fittings, only* $24

Prompt Delivery from Your Supplier or Write Direct.

W. R. BROWN CORPORATION
5714 Armitage Avenue • Chicago 39, Ill.

AIR REGULATORS • AIR FILTERS • AIR GUNS • PORTABLE COMPRESSORS

use TECO Cemented Carbide!

Because of the remarkably long-wearing qualities and long-run production of TECO Cemented Carbide, many plants are able to hold tool inventories at much lower levels than ever before.

The answer is simply that each TECO Cemented Carbide tool does so much more work . . . fewer tools are needed. And, as a result, fewer idle tools are tied up, releasing vitally needed carbides for other war plants.

TECO Cemented Carbide stays on the job longer because it is harder, denser, more uniform . . . thus more resistant to wear and breakage. It holds cutting edges and maintains accurate tolerances for longer runs, under high speed production.

We can make dependable delivery on grades, styles and sizes of TECO Cemented Carbide Tools and Blanks for practically every machining operation. Have one of our tool engineers discuss your requirements. Write for detailed catalog.

ARMY E NAVY

TUNGSTEN ELECTRIC CORPORATION 574 39th Street, Union City, N. J.
Branch Office: 2906 Euclid Avenue, Cleveland, Ohio
Representative: Architects & Builders Bldg., Indianapolis, Ind.

TECO Pioneers in Tungsten Carbides for over a Quarter Century **CEMENTED CARBIDE**

Abrasive Cloth Cone Deburrs and Rounds Edge of Holes

THE Product Engineering Department at Behr-Manning has recently announced the development of a method whereby one of the major deburring problems in the aircraft industry—the burr removal and generating of radii on the I.D. of lightening holes—is solved. These holes are generally cut or stamped in the Dural stringers and bulkheads, used as supporting elements, throughout the entire plane. They range from 2" diameter to 7" diameter and are cut out circular and elliptical in shape for the sole purpose, as their name implies, of lightening the plane.

Before a piece can become part of an airplane, the rough, uneven surface left by the router or stamping machine must be smoothed out and a slight radius produced around the edges. Former methods have all been found rather unsatisfactory, however this new method has met with the approval of at least two of the larger plane manufacturers in the East and is in operation in their plants.

The new method utilizes a special shaped, unjoined Lightening Metalite Cloth cone, designed with a 45° angle, mounted on a special cone adapter. Both were designed for specific use as a lightening hole deburrer.

The method of mounting the deburring tool found to provide the most efficient use appears to be when mounted on the shaft of a standard 1800 rpm motor of 1/3 to 1/2 hp, depending on the size of hole and the gauge of stock being deburred. The motor may be attached to the bench with the shaft at right angles to the front edge so the cone will overhang, allowing the operator to bring the sheet being sanded to the cone. Optional mountings on drill presses, etc., are, of course, possible provided the cone is not operated in excess of 2000 rpm. Speeds greater than this cause the cone to flare to a degree that makes its use impractical.

For further information on the cone adapters and cones, write the Behr-Manning Corp., Dept. TJ-11, Troy, N. Y. 110-F.

War Plane Specifications
Require Torquing
Modern manufacturing methods call for controlled "settings" of vital nuts, screws, bolts, hydraulic fittings—of almost all threaded parts. Leading American aircraft and engine builders almost universally use the permanently accurate STURTEVANT TORQUE WRENCHES for innumerable applications ranging from building precision instruments to testing frictional drag in controls and motors. 50 models, capacities ranging from 0 to 5 in. pounds on up to 7200 in. pounds.
Write for catalog sheets.
Model F-100-I
(Capacity 0-100 in. lbs.)
Illustrated
P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

Clamp, Clamp, Clamp the boys are marching—into all the important war plants of the country—doing an excellent job in helping to speed production—by holding together parts and assemblies for such operations as drilling, welding, reaming, gluing, and riveting.

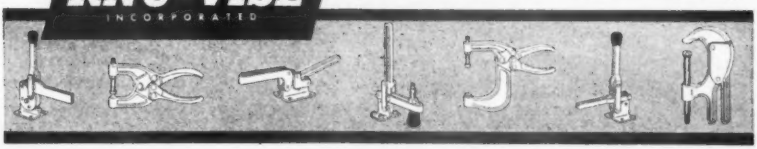
From the tiny pliers leading the parade to the huge ones in the rear, every pair is doing real service in war activity.

The small ones in front (4¾" long) hold airplane wings for multiple drilling operations. The next two models hold parts during welding, and the next two—with their deep throats—serve to hold angle irons and channel sections and other odd shapes in other war plants.

Whatever your clamping problem, Knu-Vise has a clamp that will meet your particular need and increase your production. Send for our catalog describing the entire line.

KNU-VISE
INCORPORATED

1330 Plum Street, Detroit 16, Michigan
4328 San Fernando Rd., Glendale, Calif.



Novel Sequence Numeral Stamp Simplifies Inspection, Checking and Identity

A SIMPLE system of marking parts in process so that a glance reveals the complete history of that part through the various manufacturing operations and inspections has been adopted for certain of its products by Aircraft Parts Production Corp.

When completed, a glance at the part reveals the identity of every inspector through whom the part passed, what his action was, whether the part had to go back for re-working, who sent it back, who approved it after it was reworked, etc.

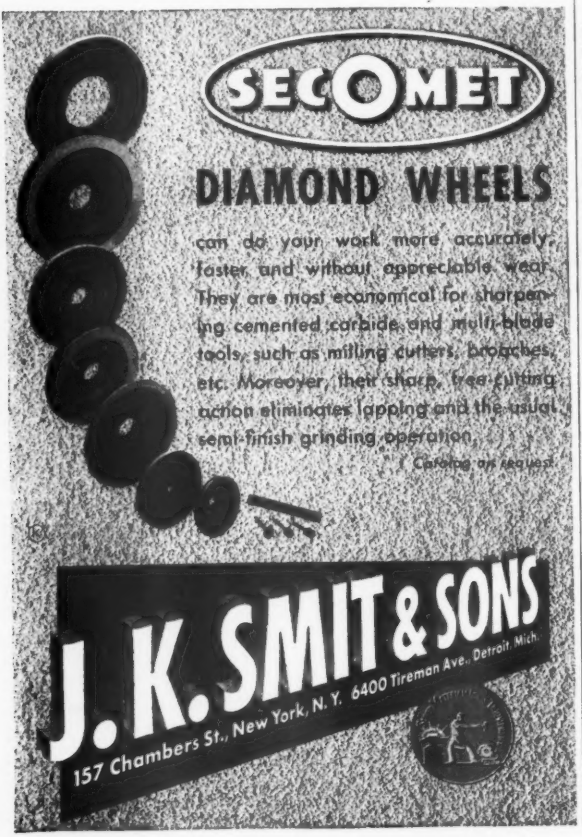
Forming the basis of the marking system is an "operations sequence" marker, produced by New Method Steel Stamps, Inc.

This "operations sequence" marker is a simple hand stamp carrying a number of consecutive numerals starting with No. 1, the number of numerals being the same as the number of operations for which inspection is required.

These numerals are impressed on a casting, for instance, immediately after a snagging operation in a position where they will not be obliterated during manufacture.

After each operation, the inspector involved marks the part above or below the numeral corresponding to the operation he is checking.

Further information will be supplied by New Method Steel Stamps, Inc., Detroit, Mich. 122-F.

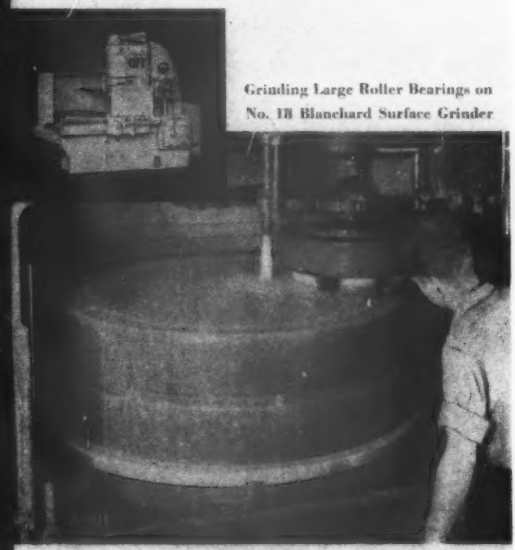

SECOMET
DIAMOND WHEELS
can do your work more accurately, faster and without appreciable wear. They are most economical for sharpening cemented carbide and multi-blade tools, such as milling cutters, broaches, etc. Moreover, their sharp, free-cutting action eliminates lapping and the usual semi-finish grinding operation.
Catalog on request
J. K. SMIT & SONS
157 Chambers St., New York, N. Y. 6400 Tireman Ave., Detroit, Mich.

"PUT IT ON THE BLANCHARD"

The job shown here is another example of large heavy work which may be ground with ease on a Blanchard No. 18 Surface Grinder with extended column and 42" chuck with extension.

These 48" diameter Roller Bearings come to the Blanchard after hardening.

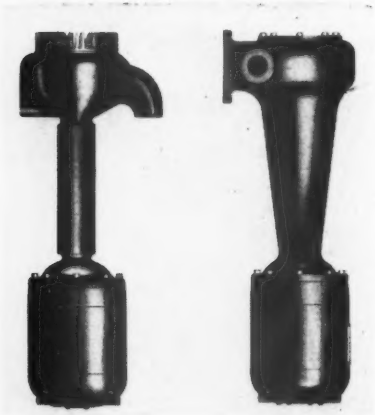
Both sides are ground, removing .050" stock from each side, and size is held to ±.001". The grinding is done in four operations in total time of 4½ hours. Each piece weighs approximately 1800 lbs.



Grinding Large Roller Bearings on No. 18 Blanchard Surface Grinder

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

The BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS., U. S. A.



War Model Pioneer Pumps

THREE new coolant pumps, each available in 17 standard sizes, fittingly called War Models, are announced by Pioneer Pump and Manufacturing Company, Detroit.

Their design, construction, and usefulness all play their respective parts in conserving critical materials. Not only in design and construction do they eliminate critical materials, but in their use as well do they contribute toward the conservation of such materials. Since constant flow is always assured, the possibility of causing scrap, due to pump failure, is greatly reduced.

The versatility of application, permitting interchangeability with other makes of pumps, enables a user to keep his inventory reduced to a minimum, for each pump presents the possibility of many different applications.

Model VBD is said to be the only pump on the market with 3 outlets to permit piping on either right or left side, or back into coolant sump through intake bracket.

Model VA is used where submersion in coolant sump is more practical or less objectionable than outside mounting would be.

Model VC was designed for external use in cases where a tank cannot be utilized efficiently, mounted with either vertical or horizontal bracket.

Because the construction, styled in the modern streamlined manner, has been standardized, quick deliveries are possible.

Pioneer Pump & Mfg. Co., 1966 John R St., has descriptive literature available. 427-F.

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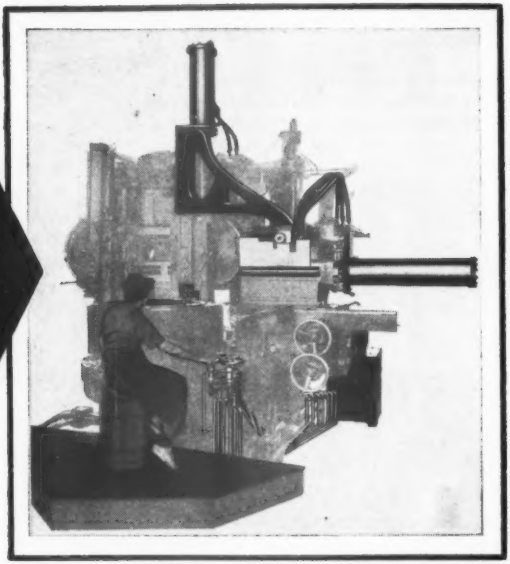

Turchan Followers attach easily to any standard lathe, planer, shaper, grinder or mill.

TIME was when die sinking demanded extreme skill and only experts were permitted to tackle the job. Today, however, ingenious mechanical devices such as the Turchan Follower have decreased the possibility of human error and lessened the necessity for such rare skill.

Take, for example, the sinking of drop forge dies — dies of almost every conceivable contour, designed to take a merciless pounding. That *used* to be a man's job. But today, thanks to Turchan Followers, the hand that rocks the cradle can sink such dies. And do it well!

The accompanying photograph shows a woman in a large forge plant operating a Turchan-equipped vertical turret lathe. She's sinking a die for drop forging an airplane engine part. Notice the easy, all-hydraulic, single valve control. Notice the cutting tool following every movement of the tracer mechanism. Above all, observe that the Turchan is merely an attachment — a relatively inexpensive attachment — to the die sinking machine.

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The Style "L" Full-Floating Collet was developed for the primary purpose of handling hot-rolled stock in automatic screw machines. Each jaw floats independently, permitting the collet to run just as true as the machine spindle. Consequently, the jaws come to a full bearing on the stock. These collets are also made with the diamond-grip serrations which extend on to the tongue of the jaw.

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Sutton Style "L" Feeders are so designed that they will handle a range of stock practically up to machine capacity. They can handle stock up to ⅛" of the capacity of smaller machines and up to ¼" of the capacity of larger machines.

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Write to Sutton Tool Co., 2895 W. Grand Blvd., Detroit 2, Mich., for catalog. 482-F.

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WITH production demands for hot forgings at an all-time maximum, several large manufacturers engaged in war work are utilizing Lincoln Equipment very advantageously in a direct pressure method of spraying hot die lubricants.

Hot die lublication is a two-part problem: the lubricant itself and the application of the lubricant to the die surface. Although they are interrelated, the method of application may or may not be able to handle the best type of lubricant.

The usual method of applying the lubricant to the die surfaces is by swabbing on by hand between operations.

In die lubrication, the essential problem is to spread a thin film of graphite evenly on the surfaces that do the work on the hot blank and thus prevent sticking, crazing and cracking of the die. The carrier medium in which the graphite is suspended burns off the die and its essential purpose is to hold the graphite in suspension so that it can be applied to the surfaces. In swabbing, the carrier medium has to be sufficiently light so that a swab can be dunked in it and the resultant drippage and wastage is enormous. In addition, the coverage of the surface is uneven, the general conditions around the press are messy and additional time and labor are required.

In spraying with direct pressure, the carrier medium of the lubricant is a semi-solid grease or oil that holds the graphite in suspension. This eliminates the necessity of stirring or remixing. The lubricant is put up in standard 55 gal. drums and the pump takes the lubricant directly from the drum to a valve which controls the flow to the spraying nozzle.

As the total weight of the control valve and nozzle is about 10 lbs., it can be rigged up so that the operator can handle it by hand. It can also be set up so that the operation is automatically performed by the press itself.

Operating details, illustrations and specifications covering this equipment are available from the Lincoln Engineering Co., 5703 Natural Bridge Ave., St. Louis, Mo. 367-F.

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METHODS OF MEASUREMENT by Wendell H. Cornetet, Head, Department of Vocational Science, Huntington East High Trades School, Huntington, West Virginia. This elementary and vocational text is a most practical aid to both industrial and public classes in shop work. It thoroughly covers lineal measurements as made with scales, calipers, micrometers, and clearly outlines the function of vernier scales. Geometrical measurements are treated as they relate to tool work, thread angles and protractors. Many fields of measurement are treated in this text that are not usually covered in a shop text. For many of them, such as Specific Gravity, Tension, Bending, Torsion, and Temperature, laboratory apparatus not usually found in shops is necessary but the author's explanations of the procedures and lucid diagrams of the set-ups are so explicit and detailed as to be highly educational even without benefit of laboratory facilities. Formulas, tables and scale and vernier diagrams that can be cut out and used for demonstrations complete the text. The book is available for 95c from McKnight and McKnight, Bloomington, Ill.

DESIGN OF MACHINE MEMBERS by Alex. Vallance, Chief Designer, Reed Roller Bit Co., and V. L. Daughtie, Professor of Mechanical Engineering, University of Texas.

This text has been prepared for the use of students who have had some training in kinematics, mechanics and factory processes. With these subjects as a foundation there follows an explanation of the theory involved in the design of the elements of operating mechanisms and machines. Proper emphasis is given in the pointing out of the variations in and departures from theory as required by practical constructional and operational applications.

A number of selected derivations have been included to give the student practice in the analytical methods involved in design. Some design problems have been worked out in detail to illustrate practical application of theory to actual design and numerous problems for class or home solution have been included at the end of the text. Considerable space has been devoted to engineering materials, factors of safety, utilization factors, and the selection of design stresses, since good judgment in this phase of design is necessary to the designing engineer.

In revising the text for the 1943 second edition, the authors have attempted to maintain most of the original text with such additions and revisions as are required by new developments in materials and design procedure. Additional information on nonferrous materials has been added because of their growing importance in present-day designs. Some information dealing with the recently developed nonmetallic materials such as plastics, synthetics, and so-called rubber substitutes has been included.

The order of the chapters has been changed to provide a better continuity of subject matter and some chapters have been largely rewritten in an attempt to clarify some subject matter and to incorporate recent developments.

DESIGN OF MACHINE MEMBERS is published by the McGraw-Hill Book Co. of 330 West 42nd St., N. Y., N. Y., from whom it may be obtained for $4.00.

HELICAL MILLING by C. A. Felker, Head of the Department of Vocational Education, University of Toledo, and H. W. Paine, Professor of Vocational Education, University of Cincinnati.

Ability to do the setup work and handle the mathematics involved in helical or spiral milling marks the master mechanic in the machine shop. Mechanics who are competent and confident workers with the milling machine's regular indexing attachment hesitate to undertake jobs involving helical milling with the spiral attachment. Yet fundamentally the only additional difficulty involved in the latter skill is computing the change gears and swiveling. When the mathematical problems involved are attacked clearly and thoroughly as they are in this book, the mechanic will find himself able to handle the entire area of helical milling, thereby tremendously increasing his field of usefulness.

HELICAL MILLING presents, first, the fundamentals of the helix and helical milling, following this introduction with a detailed study of different types of helical milling procedures, from the simplest to the most complex problems that the mechanic will encounter. Throughout the book practical problems are emphasized and the most commonly used types of indexing attachments are thoroughly covered. Computations are kept as simple as possible, while a special table of logs for ratios is offered to reduce the intricacies of handling logarithms.

Published by the Bruce Publishing Co., Milwaukee, Wis., HELICAL MILLING is offered in cloth binding for $2.00—paper bound, $1.00.

PRINCIPLES OF PHYSICAL METALLURGY by Frederick L. Coonan, Lieutenant Commander, U.S.N.R., Associate Professor of Metallurgy, Postgraduate School, United States Naval Academy.

Metallurgy, a science devoted to the study of metals and alloys, is divided into two important branches. One division and by far the older is concerned with the methods and principles involved in the extraction of metals from their ores and the subsequent operations necessary in refining these metals and producing alloys suitable for commercial use. The term production or chemical metallurgy is used to designate this branch of the subject.

The second significant division of metallurgy, referred to as physical metallurgy, is devoted in general to the study of the behavior of metals in the process of fabrication and use.

It is this latter branch of the science that is treated in Coonan's text.

(TO PAGE 166—PLEASE)

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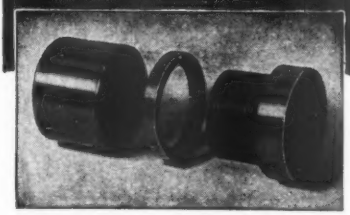

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(CONTINUED FROM PAGE 164)

His subject matter is organized into three clearly defined parts, which together provide an orderly and logical development from fundamental principles to essential binary diagrams.

Part One treats the fundamental principles which are essential to the understanding of the nature and characteristics of the commercially important metals and alloys. Here the author considers the nature of metals, fundamental equilibrium diagrams, the solidification of metals, and changes in the solid state.

Part Two discusses the characteristics of the commercially important non-ferrous alloys: brasses, bronzes, bearings, mechanical deformation, age hardening, aluminum alloys, etc.

Part Three discusses in the same manner the alloys of iron and carbon. Here are covered the allotropic forms of iron, the iron carbon diagram, carbon steels, the heat treatment of steel, cast irons, alloy steels, high test cast irons, tool steels, corrosion, corrosion-resisting alloys, heat-resisting alloys, and welding metallurgy.

The material throughout is presented in a clear and simple manner, designed for the beginning student. Controversial matters are omitted, as well as other matters that might serve to confuse the beginner in this field.

The text is fully illustrated with photomicrographs, and references are provided for those interested in further study.

PRINCIPLES OF PHYSICAL METALLURGY contains much information of vital significance for the war production program. It is an outstanding textbook in its field, especially when wartime needs put a premium upon a brief, simple and authoritative presentation of basic facts.

This book may be obtained from Harper & Brothers, 49 East 33rd St., New York 16, N. Y., and is priced at $3.25.

MILLING MACHINE INDEXING by C. A. Felker, Personnel Director, Marion Steam Shovel Co., and H. W. Paine, Professor of Vocational Education, University of Toledo.

The subject of indexing has been treated only in a very fragmentary manner by practically all shop-mathematics texts and by most handbooks dealing with the subject of machine mathematics. The authors ascribe many causes to the absence of a complete indexing text and state that perhaps the most pertinent one is the fact that indexing covers an extremely extensive and varied field as far as its applications are concerned, and most writers have seen fit to treat only the most common procedures involved in direct, simple and perhaps differential indexing, with a few applications to show the procedures in typical problems.

(TO PAGE 168—PLEASE)

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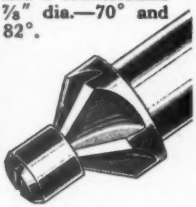

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(CONTINUED FROM PAGE 166)

In the material presented in MILLING MACHINE INDEXING Felker and Paine give the matter of indexing a much more thorough treatment than has hitherto been attempted. They have presented one entire chapter on each of the five accepted types of indexing — direct, simple, differential, block and compound, with explanations and sample problems showing the best fields of application of each. In addition to the mathematics involved, they have presented a generous amount of trade information concerning the indexing attachment in common use so that the constructions and operations of the several available types can be easily understood.

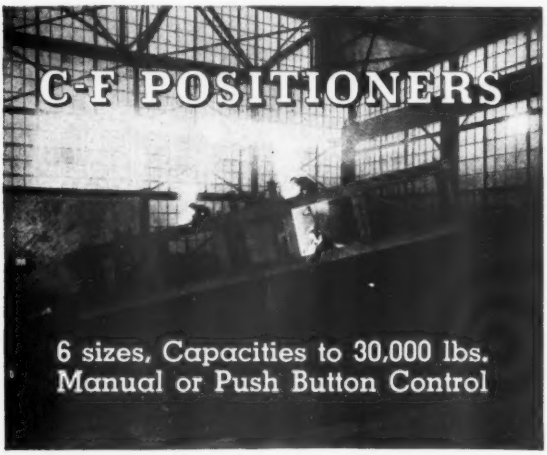
The instructional materials in MILLING MACHINE INDEXING are so arranged that the book may be used either as a machinist's reference book or as a classroom text for the upper grades of vocational or technical high schools, or for apprentice and employee training classes, or for college engineering machine shop classes.

MILLING MACHINE INDEXING is available from the publishers, The Bruce Publishing Co. of Milwaukee, Wis., cloth bound, for $1.50.

PIPE AND TUBE BENDING HANDBOOK—published by the Copper & Brass Research Association, 420 Lexington Ave., New York 17, N. Y., outlines practical methods for bending pipe and tubes of copper, brass, and their alloys. Work in the two large classifications—the routine bending of pipe and tube of relatively small diameter for a wide variety of commercial assemblies and installations; and the specialty bending of large diameter tube for particular applications are described and illustrated. The many useful tables (weight tables; tables of gage or wall thickness tolerances, mean diameter tolerances, tolerances for specific lengths; etc), the shop application photographs and line drawings with brief, concise captions, and the well-developed text all combine to make this Handbook indeed a highly valuable "Shop Aid". Send for your copy, free upon request. **729-F**

"THE ABC OF INTERNAL GRINDING"—intended primarily for operators of internal grinding machines, endeavors to answer some of the most commonly asked questions such as "how to select the proper wheel for different internal grinding jobs, and how to correct common grinding faults." The booklet discusses the basic requirements of an efficient grinding machine operator—(1) a knowledge of his grinding machine—its parts and

(TO PAGE 170—PLEASE)



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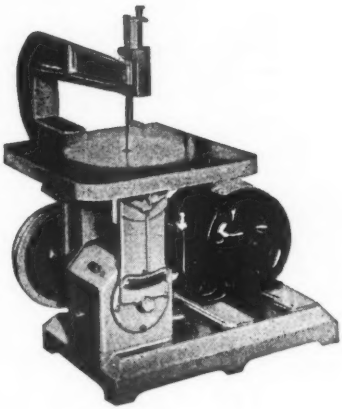

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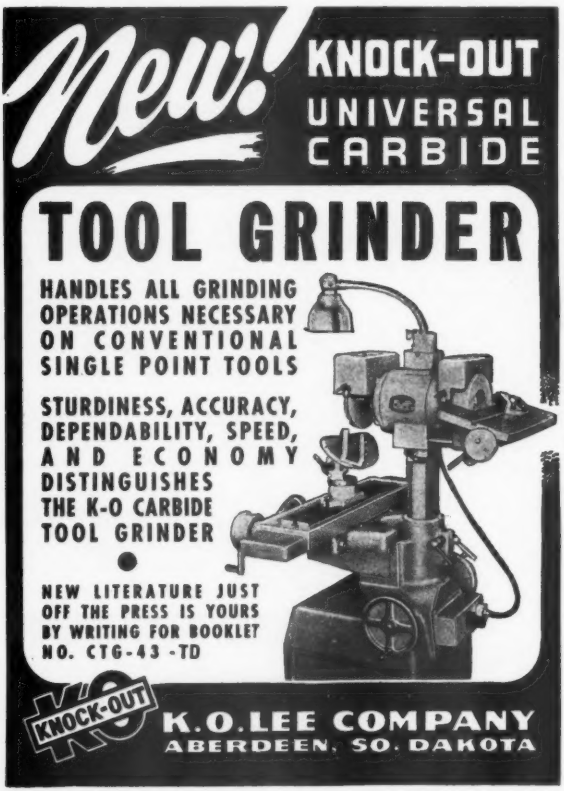
(CONTINUED FROM PAGE 168)

controls, how to take care of it and how to set it up for each job; (2) ability to select the proper size, grain and grade of grinding wheel for each job; (3) ability to quickly recognize grinding troubles and to correct them.

Functional diagrams of Bryant and Heald internal grinding machines; excellent shop photographs typical of all Norton publications; and tables of recommended wheel and grinding wheels speeds make this manual valuable to student and experienced operator alike. Copies are available from Norton Company, Worcester 6, Mass. Ask for Booklet 436TD. **545-F**

BALANCING WAYS, power scrapers, ball bearing turn tables, spotters, hand scrapers, hydraulic hand presses and roto-checkers are described and pictured in a complete catalog issued by ANDERSON BROS. MFG. CO., 1910 Kishwaukee St., Rockford, Ill. The improved balancing ways for aircraft propellers are easily demountable and are equipped with four chilled-iron discs mounted on hardened spindles which rotate on supersensitive ball bearings. **190-F**

TECHNICAL DATA ON metal-sawing operations, together with practical suggestions for merchandising and sales promotion of the complete line of Star Hack Saw Blades, Frames, Power Saws and Band Saws is contained in Catalog No. 43-S issued by CLEMSON BROS., INC., Dept. TD, Middletown, N. Y. Instructions for using various types of blades including hand and power blades are given The proper selection and use of blades on different kinds of metal and at different cutting speeds is outlined. Details and illustrations of the proper use of the Star Hack Saw Frame with its lever-lock automatic tension adjustment are included. The merchandising section offers several service ideas for distributors and dealers. Sales promotion plans, displays and suggested resale schedules are included. **791-F**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FUNDAMENTALS OF ELECTRONIC CONTROL FOR RESISTANCE WELDING—an attractive 46-page booklet (GET-1170), consisting for the most part of published articles by General Electric engineers on the circuits and operating characteristics of electronic controls for resistance welding, has been made available by the General Electric Company, Schenectady, N. Y. In the booklet, simplified circuit diagrams are used liberally in explaining the fundamentals of the many types of G-E electronic controls designed to meet the exacting requirements of individual

(TO PAGE 172—PLEASE)

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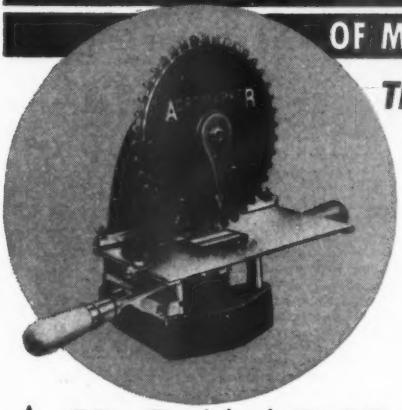


THE *ACROMARKER*

The No. 1 Model is especially suited for fast marking, numbering and lettering serial numbers, voltage indications, code letters, identification marks, manufacturers' key, etc. Easy to operate, the No. 1 Acromarker requires merely a swing of the handle to exert powerful screw pressure of the dies on the parts to be marked. Deep, accurate marking on stainless steel, cold rolled steel, brass, bronze, zinc, tin, plastics, fibre or other materials. Dies are automatically advanced for character spacing, and are replaceable. The Acromarker represents one of the most widely used marking machines on the market today

ACROMARK

THE ACROMARK COMPANY

515 MORRELL STREET ELIZABETH, NEW JERSEY

Write for descriptive literature.

(CONTINUED FROM PAGE 170)

resistance welding processes and job applications.

Titles of the six articles reproduced in the booklet are: Electronic Welding Control; Seam and Pulsation Welding Controls; Special Welding Controls; Timers for Welding Control; Energy Storage Welding Controls; and Servicing Resistance Welding Controls.

A pictorial presentation of all types of G-E electronic controls for resistance welding follows the text. Also portrayed are the many electric accessories G.E. has produced for resistance welding processes, including an electrode pressure gage, the magnetic oscilloscope, cable, capacitors, motors, air circuit breakers and their pointer-stop ammeter. **77-F**

VERSATILITY describes the Thompson Universal Milling Fixture which is designed specially for use on any standard bench lathe. It can be efficiently used for milling punches, end mills, key ways, counterbores or in the manufacture of duplicate parts. A time-saving, work-saving aid to production, and especially adapted for use in automotive, aircraft and precision repetitive production work is the Willard Spring Tool Holder. The new style Thompson Spring Collet Adapter, consisting of only two parts, eliminates large heavy chucks and provides free access to work and cutter. Further information on these toolroom and production specialties may be had by writing the AUTO-ORDNANCE CORP. (Thompson Tool Div.), 349 W. Putnam Ave., Greenwich, Conn. **640-F**

REPRESENTING AN ADVANCEMENT in the art of welding is Rex-Flex Stainless Steel Flexible Tubing and Bellows described in a new illustrated engineering manual (SS-44) published by CHICAGO METAL HOSE CORP., Dept. J, Maywood, Ill. Characteristics of the product are shown in detail, with tables of sizes, weights, wall thicknesses of the various wall forms, together with pressure data, minimum bending radii and a number of other details essential to the engineer. Complete data on fittings along with diagrams and instructions for attaching fittings and recommended design procedure for various types of applications are included. **789-F**

SPECIAL FEATURES and details of "Exidust" equipment for cleaning industrial plants and buildings of all types are described in Bulletin D4 recently issued by ALLEN BILLMYRE CO., 438 Fayette Ave., Mamaroneck, N. Y.

(TO PAGE 174—PLEASE)

DOUGLAS *Precision* SLOTTER

FOR TOOL ROOM AND PRODUCTION

A wide range of service is assured by the Douglas Precision Slotter because of its vertical design, swiveling ram head and tool holder. Automatic circular table with independent automatic feeds in all directions gives the machine greater flexibility and a further advantage of easy mounting of work without the need of costly fixtures.

Control levers are conveniently located, permitting quick, smooth operation and better observation of work during operation.

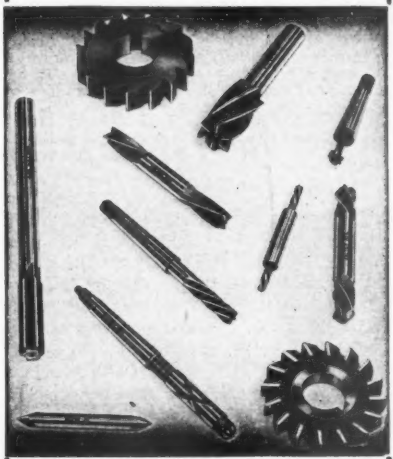
Typical production parts machined on the Douglas Slotter.

DOUGLAS MACHINERY CO., Inc.

150 BROADWAY • NEW YORK, N. Y.

IMMEDIATE DELIVERY FROM STOCK
On Standard Sizes

GALTER
HIGH GRADE TOOLS



DEPENDABLE PERFORMANCE *Guaranteed*

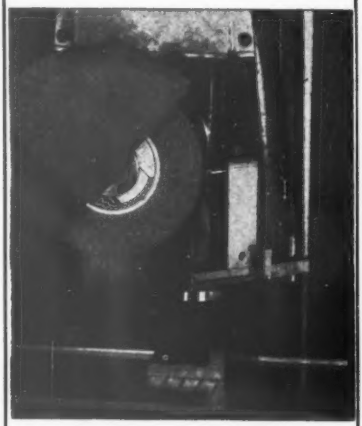
Plain Milling Cutters
Side and Face Milling Cutters
Stagger Tooth Side Milling Cutters
Shell End Mills
Slot Cutters
Taper Shank Cutters
Spiral End Mills
Counterbores
Countersinks
Reamers
Hollow Mills
Taper Shank Drills
Straight Shank Drills

Prompt Delivery on Special Tools, Dies, Jigs And Fixtures Made To Your Exacting Requirements

Write for prices on standard sizes or submit blueprints for quotations on special sizes.

Galter Manufacturing Co.
711 W. Lake Street - Chicago, Ill.

The FORM-MASTER
ANGLE AND RADIUS DRESSER



An all-purpose angle and radius dresser for high-precision at low cost. Accurate easily within .001". Simple to operate. Dresses in horizontal position enabling operator to SEE the form in work. All parts hardened and ground (except cast-iron base which can be drilled and tapped). Suitable for surface and cylindrical grinders. Two 1/3 ct. quality diamonds and instrument case included.

It readily produces: Any desired angle; Convex radii to 4"; Concave Radii to 7". On 7" wheel.

Specifications: Base 3"x3", height 8½"; Wheel capacity 8"; Angular travel 3".

For information or a demonstration CALL YOUR SUPPLIER.

MANUFACTURED BY
J & S. TOOL CO. 477 Main St., East Orange, N. J.
PRECISION DRESSING TOOLS

(CONTINUED FROM PAGE 172)

This bulletin concisely outlines the benefits of this type of cleaning system and illustrates sectional views and typical installation layouts. Exidust is widely used by ordnance plants, arsenals, refineries, etc., and swiftly cleans floors, walls, ceilings, pipes, structures, machinery, containers, cars and rooms. **788-F**

FOUR MACHINES IN ONE—three drilling spindles and one tapping spindle — describes the "Landau" Combination Drill Chuck and Tapping Device for drilling, tapping, reaming and countersinking, described and illustrated in a 4-page bulletin issued by LANDAU MACHINE & DRILL PRESS CO., 550 Fifth Ave., N. Y. C. The machine permits a series of operations to be performed without removal of the work from the table, thereby saving labor—time—space—money and power. It is offered in both bench and floor models and is operated by a ¼ H.P. motor. **787-F**

HAND SCRAPED TO .0002" FLATNESS are Barco straight edges, surface plates and angle irons which have also the advantages of "Meehanite" construction, all fully described and illustrated in a leaflet issued by the BARCO SCRAPING CO., 1975 E. 65th St., Cleveland 3, Ohio. Barco Slotted Angle Irons are so rugged that they are often used as bases for jigs and fixtures. The tops of Barco Surface Plates are thicker than usual which lengthens their life because it permits more re-planing and re-scraping. Barco Straight Edges are constructed of Meehanite, are heat-treated and hand-scraped. **154-F**

This BOOK tells how to speed your Inspections

Send for your free copy

with the *New*

TRICO MICRO-CHEK

PRODUCTION GAGE

Priced from $9.75 up

More than 3100 war plants now use thousands of TRICO MICRO-CHEKS to speed up the gaging of millions of precision parts. With it, inexperienced workers quickly become dependable inspectors. Our new booklet shows many further uses of this accurate, speedier gage. Write for this timely information.

TRICO

TRICO PRODUCTS CORP.

Room 125 Trico Building, Buffalo, N. Y.

A PACKET OF ILLUSTRATED literature describing six DoAll products is available from THE DOALL CO., 1203 Thacker St., Des Plaines, Ill. Their Abrasive Band for rough finishing and polishing is available in 50, 80 and 150 grit. DoAll Steel Ink has been developed for precise layout work on dies, templates and machine parts; for locating high spots on scraped machine ways; for determining the fit of mating surfaces and for checking gear tooth contact. DoAll Grinding Wheels are fast and accurate and are made to exacting specifications for use on DoAll Surface Grinders and other grinders with spindles of 1¼" or 3" diameters. DoAll Cutting Oils are recommended for cutting ferrous and non-ferrous metals and DoAll 470 Soluble Oil is used for threading, tapping, broaching, sawing, hobbing and milling. DoAll Saw Eez is a saw-

(TO PAGE 176—PLEASE)

LOOK FOR THE HONEYCOMB BASE!

HIGH PRECISION SURFACE PLATES

Meehanite Metal Surface Plates are famous for their honeycomb base—which distributes the weight scientifically. Because Meehanite Metal is of fine close grain, uniform texture and extraordinary strength and solidity, these are definitely high precision plates. The surfaces are hand scraped to extremely close tolerances.

They are available in 22 standard sizes ranging from 3½ x 4 to 48 x 96. They weigh from 5 lbs. to 6000 lbs., are from 2½" to 12" in height, while tolerance ranges from .0001" to .0005". Other sizes to specification. Angle plates and straight edges of Meehanite Metal also available. Good deliveries on most sizes. Write for folder. Prices on request.

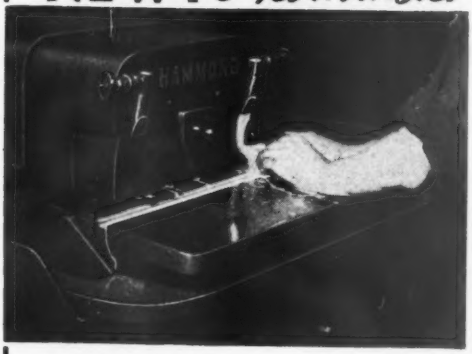
ACME TOOL COMPANY - 196 CHURCH STREET NEW YORK 13, N. Y.

NEW! Hammond 10" and 14" WET TOOL GRINDERS

FOR

CARBIDE TOOLS and HI SPEED, Too!

Grinding wet, helps prevent tool tip crazing and flaking, and eliminates heat cracks.



New features of the Hammond 10 and 14: No Spray-No Splash concealed wheel guards provide greater operator freedom and complete visibility of work; Adjustable Coolant spouts swivel in and out with flooding action of the coolant; Safety Cup disc prevents operator from accidental dropping of tool into cup of cup wheel.

SEND FOR BULLETIN NO. 206

Hammond Machinery Builders INC.
KALAMAZOO 54 . MICHIGAN
1631 DOUGLAS AVENUE
Eastern Branch—71 W. 23rd St., New York 10, N. Y.

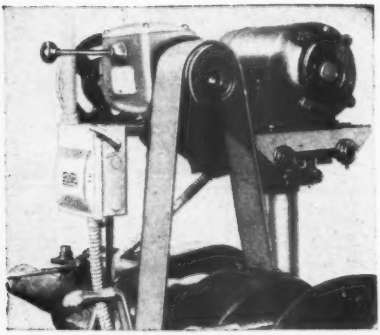
(CONTINUED FROM PAGE 174)

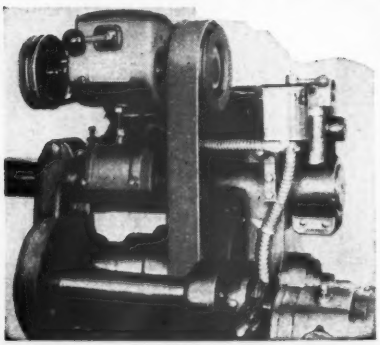
ing lubricant which reduces scoring and lengthens saw life. **130-F**

A COMBINATION technical instruction book and sales manual, Catalog No. 43-V, has been released by VICTOR SAW WORKS, INC., Dept. T, Middletown, N. Y. The entire line of Victor blades including both hand and power blades is described. For each type of blade, tables of working specifications are given suggesting the proper hand or power blade for every kind of metal-sawing operation. A special section is devoted to their hack saw frame, with illustrated instructions for its proper use in order to get the best results. The merchandising section offers ideas and plans for sales promotion aimed at greater sales and profits for distributors and dealers. **790-F**

PLANE AND FLIGHT INSTRUCTION KIT—With an eye to a boom in post-war "personalized" aviation, The Piper Aircraft Corp. of Lock Haven, Penna., has prepared a kit of instructional material for teachers engaged in furthering a knowledge of the rudiments of flight and aircraft construction. The Kit is made up of a series of wall charts showing: the Piper Club L-4 (Army Type) in full color; airplane, instrument panel and control system nomenclature; movement of controls and effect upon altitude and flight; and working blueprint of Piper Cub from which a class can construct an accurate 24" scale model. The kit is completed with a "You Too Can Fly" booklet explaining basic flight principles prepared by a government certified flight instructor. For one dollar aviation enthusiasts may obtain the Aviation Instructor Kit from the Piper Factory.

LATHES, MILLING MACHINES





shapers, turret lathes, radial drills, slotters, etc., are motorized with WESTERN MASTER (1-5 h.p.) Transmissions with bracket $95

WESTERN MAJOR (5-10 h. p.) Transmissions with bracket $145

and a WESTERN SUPER (up to 30 h. p.) for replacing gear boxes on large boring mills, radials, Gisholt milling machines, etc.

We can also supply necessary V-belts, sheaves, output pulleys and motors from stock. Prompt deliveries on high Priorities.

◆

Send for new 4-page catalog.

up to 30 h. p. For Motorizing Lathes, Milling Machines, Shapers, Turret Lathes, Radial Drills, Slotters, Ball Cutters, Gear Cutters, Die Sinkers, Boring Mills, etc.

WESTERN TRANSMISSIONS

3400 SCOTTEN AVENUE **DETROIT, MICHIGAN**

AN INGENIOUS DRILLING CALCULATOR of the slide rule type is available from the Fosdick Machine Tool Co., Cincinnati 23, O.

Starting by reference to a table of correct surface speeds in feet per minute for brass, bronze, cast iron, malleable iron, mild steel, steel castings and tool steels, one setting of the slide gives the correct drill rpm for a range of drill sizes from $\frac{1}{16}$" to 2"

Likewise, one setting of the slide for the proper combination of drill rpm and feed per revolution gives the time in minutes necessary to drill (A) to the full conical depth of a 118° included angle drill point, and (B) holes through stock ranging from $\frac{1}{8}$" to 3" in thickness.

Finally, from a table of "setting numbers" which are functions of feeds per revolution and the several materials covered, one "drill diameter setting" of the slide gives the required horsepower for the full rpm range. **294-F**

TOOL MAKER'S BENCH LAP SET

Boyar-Schultz

COPPER HEAD LAPS

Tool and Die Makers save valuable time having the Boyar-Schultz Tool Makers' Bench Lap Set always instantly available.

The Set is made up of seven of the sizes most frequently used in tool and die work. Keep them on the tool makers' bench — always convenient.

Complete Set consists of one Lap each of the following sizes: 1/8" — 3/16" — 1/4" — 5/16" — 3/8" — 7/16" — 1/2", 7 in all; convenient die cast Base holding Laps and extra sleeves; one 6-oz. can of Lapping Compound.

PRICE **$7.50** Complete

BOYAR-SCHULTZ CORPORATION
2112 WALNUT STREET
CHICAGO

"It's the Biggest Little Tool in the Crib"

Walton TAP EXTRACTORS Back Out Broken Taps

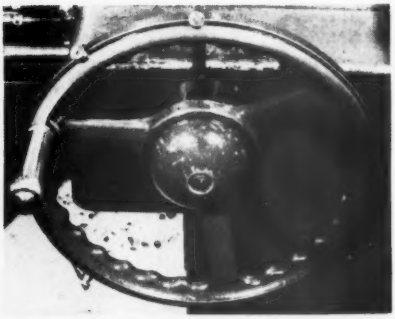
WALTONS cut costly delays and production slowups caused by broken taps. Your tool makers and machinists should have them available in necessary sizes. Many shops say they wouldn't be without them.

Immediate Shipment of all sizes against rated orders. 48 hour Reconditioning Service for your broken and damaged tap extractors.

Write for Folder No. 13

The WALTON Company
94 ALLYN STREET · HARTFORD, CONN.

(CONTINUED FROM PAGE 127)



Calibrated Handwheel for Uniform Dimensions

A CALIBRATED handwheel for turret lathe cross-slide longitudinal travel, used with or without the regular machine stops, has been devised at the Pittsfield works of the General Electric Company to obtain closer and more uniform dimensions than can be obtained with stops alone.

The wheel periphery is graduated to represent 0.005" travel for each mark and has adjustable pointer clips which slide in a "T" slot in the outer edge of the wheel. The outside diameter is turned flat before being graduated and, when the handle is removed from the wheel, the slot is machined for the pointer clip bolts to slide in easily.

An opening through which the "T" head bolts may enter the groove is provided at the point where the handle bolts to the wheel. When the handle is in place, the bolts are prevented from leaving the slot. Thumb nuts for the "T" bolts, which can be easily adjusted, hold the pointer clips in place.

When the handwheel is used with a stop, the stop is permitted to kick off the feed before the full travel and the cut is completed by turning the proper pointed clips up to the reference pointer. Uniform dimensions to within 0.001"-0.0015" are permitted by the use of this method.

Send us your
SPRING PROBLEMS
● If you need special design, special quality or special delivery, the chances are we can help you. Redesign may modify costs, too. This specialized organization, recognized headquarters for all that is latest and best in spring making, is at your service.
WM. D. GIBSON CO.
1800 Clybourn Ave.
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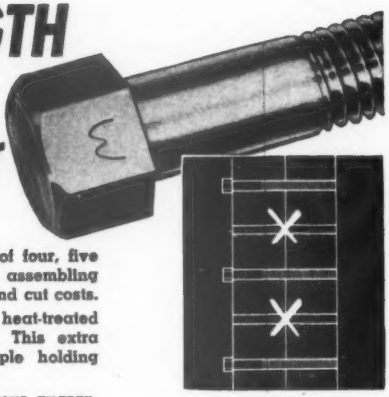
65 Years of Knowing How RESULTS IN BETTER SPRINGS
GIBSON-SPRINGS
INQUIRIES INVITED . . . LARGE ORDERS . . . SMALL

EXTRA STRENGTH
Can Save Time and Labor



When three screws can do the work of four, five or more, they save drilling, tapping and assembling time and labor. They speed production and cut costs.

Mac-It Hexagon Head Cap Screws are heat-treated for maximum strength and toughness. This extra strength can be used to provide ample holding power with fewer screws.

The Mac-It "m" on the hex head is your guarantee of quality. It appears on all diameters ¼" to ¾", inclusive.

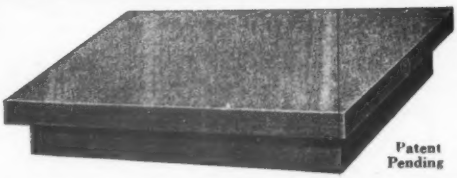
OTHER MAC-IT PRODUCTS INCLUDE:
Hexagon Socket Cap Screws, Hollow Set Screws
Hollow Pipe Plugs, Stripper Bolts
Square Head Set Screws

Mac-its
PRONOUNCED "MACK-IT"

Strong, Carlisle & Hammond Company • Cleveland, Ohio

SAVE METAL WITH THESE

HERMAN
PRECISION GRANITE



Patent Pending

SURFACE PLATES

More than just a satisfactory substitute for plates made out of war-vital metal . . . Herman PRECISION GRANITE Surface Plates are a *distinct improvement — definitely superior* in every respect. Cut from solid blocks of natural granite — far harder than any tools which will be used on them—they are absolutely warp-proof and remain accurate to 1/10,000 inch overall. Because they do not become charged with abrasives, even when used near grinding machinery, wear on tools is virtually eliminated. Both rust and corrosion-proof, they are practically indestructible. Already in nation-wide use in scores of important shops. Write today for full details on how Herman PRECISION GRANITE Surface Plates can increase production efficiency and economy in your shop.

Standard Sizes and Weights

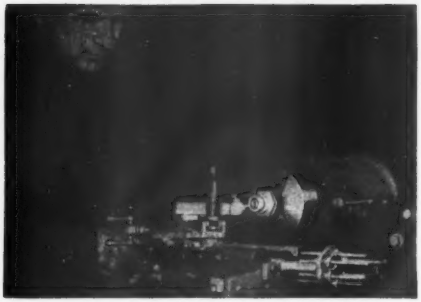
12" x 18" —— 75 lbs.	20" x 30" —— 275 lbs.
18" x 24" —— 160 lbs.	24" x 36" —— 480 lbs.

Special Sizes on Request • Prices are Reasonable • Write for Illustrated Descriptive Circular

THE HERMAN STONE CO., 1243 LEONHARD ST., DAYTON 4, OHIO

MULTIPLE CROSS SLIDE STOP

SETS 6 DIAMETER STOPS FOR REPEAT OPERATIONS



AMERICAN MODEL DS-1

- PREVENTS SPOILED WORK
- INCREASES PRODUCTION
- MAKES IT UNNECESSARY TO WORK BY DIAL GRADUATIONS

All necessary parts are supplied with each Multiple Cross Slide Stop.

IMMEDIATE SHIPMENT FROM STOCK. RUSH ORDER AND PRIORITY TODAY.

MODEL DS-1 FITS ATLAS, LOGAN, SOUTH BEND, AND SIMILAR LATHES. COMPLETE **$19.85**

SOLE AGENTS

SCHULTZ & ANDERSON CO.

107 EDISON PLACE, NEWARK 5, N. J.

In War, as in Peace . . .

CERRO ALLOYS

SAVE TIME and CUT COSTS!

CERROMATRIX (Melting Temp. 250° F.) For securing punch and die parts, anchoring machine parts without expensive drive fits, short run forming dies and other metal-working applications.

CERROBEND (Melting Temp. 158° F.) Used as a filler in bending thin-walled tubing to small radii. Easily removed in boiling water. Also used for aircraft assembly jigs, templates for forming dies and other purposes.

CERROSAFE (Melting Temp. 190° F.) Used to accurately proof-cast cavities such as molds, gun chambers, forging dies, etc. and for many similar applications.

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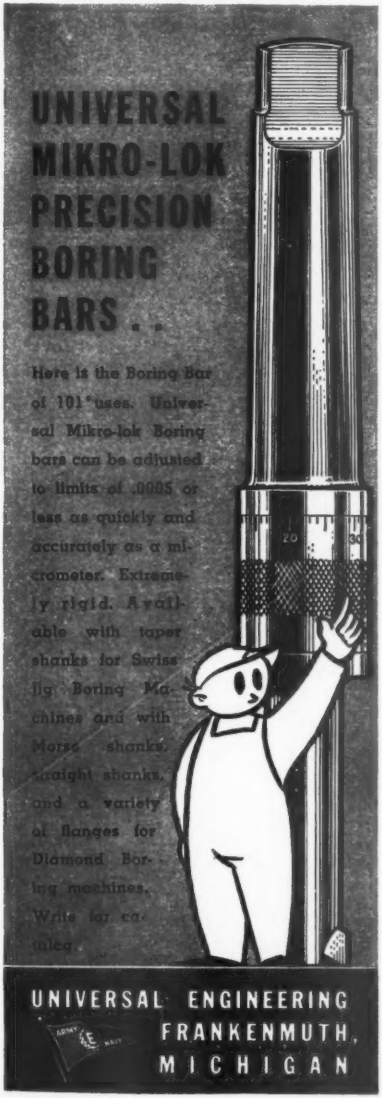
CERRO DE PASCO COPPER CORPORATION

40 WALL STREET NEW YORK, N. Y.

For continued meritorious service on the production front, the American Foundry Equipment Co., Mishawaka, Ind., has been awarded the White Star to be added to its Army-Navy "E" Production flag originally awarded on March 20, 1943.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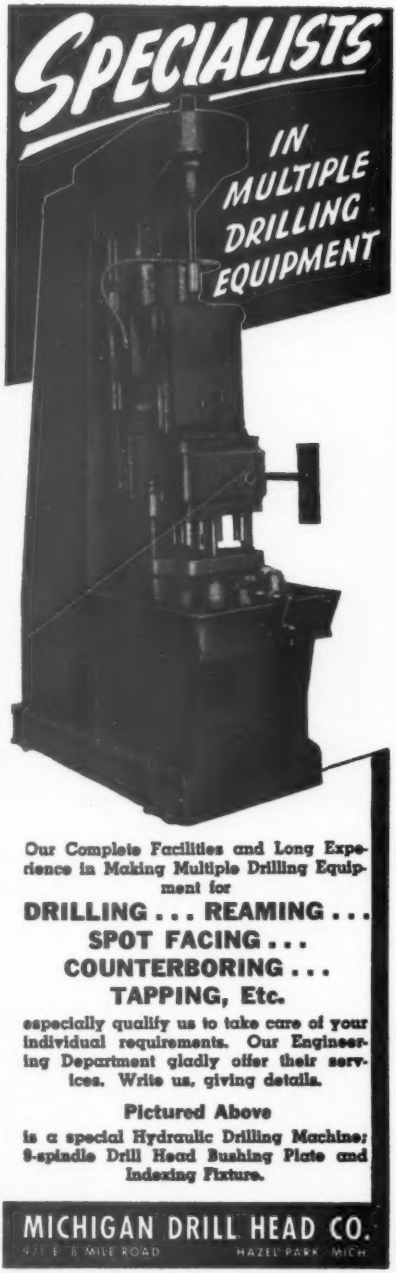
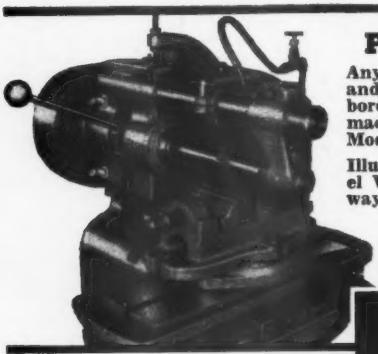
PRECISION
BORING
BARS . . .
Here is the Boring Bar of 101 uses. Universal Mikro-lok Boring bars can be adjusted to limits of .0005 or less as quickly and accurately as a micrometer. Extremely rigid. Available with taper shanks for Swiss Jig Boring Machines and with Morse shanks, straight shanks, and a variety of flanges for Diamond Boring machines. Write for catalog.
UNIVERSAL ENGINEERING
FRANKENMUTH,
MICHIGAN


SPECIALISTS
IN
MULTIPLE
DRILLING
EQUIPMENT
Our Complete Facilities and Long Experience in Making Multiple Drilling Equipment for
DRILLING . . . REAMING . . .
SPOT FACING . . .
COUNTERBORING . . .
TAPPING, Etc.
especially qualify us to take care of your individual requirements. Our Engineering Department gladly offer their services. Write us, giving details.
Pictured Above
is a special Hydraulic Drilling Machine; 9-spindle Drill Head Bushing Plate and Indexing Fixture.
MICHIGAN DRILL HEAD CO.
HAZEL PARK, MICH.



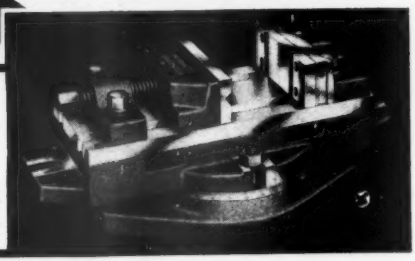
Producto Tool Room Vises

Anything from a small precision, hardened and ground Vise for surface grinders or jig borers to large heavy duty Vises for milling machines comprises the Producto line of Modern Machine Vises.

Illustration below shows 6″ Heavy Duty Swivel Vise with hardened and ground jaws and ways on body.

Ask for new bulletins on these tools.

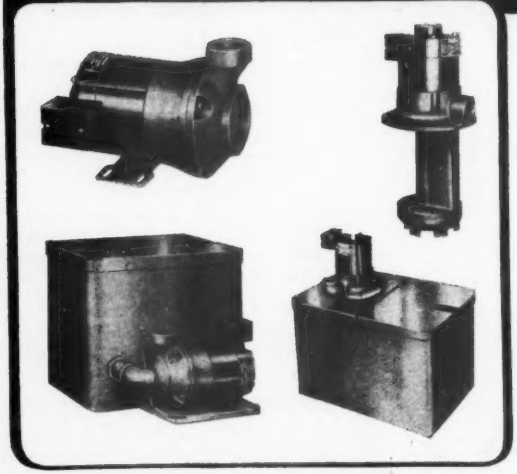
Also manufacturers of Producto Die Sets and Die Makers' Accessories.



THE
PRODUCTO
MACHINE COMPANY

990 HOUSATONIC AVE., BRIDGEPORT, CONN.
3017 MEDBURY DETROIT, MICH.

Penrod Centrifugal Coolant Pumps



Penrod Pumps Easily Applied, Give Better Service

Penrod Pumps are conventional in style but incorporate many new features such as replaceable seal assemblies, totally enclosed motors, grease sealed ball bearings and streamlined design.

Model P-10h pump (left) uses the motor for mounting and can be located in any position as long as the liquid will flow into the pump by gravity. This pump is easily installed on old or new machines. Model P-30 V Pump (right) is for submerging into the coolant reservoir, and is especially suitable for use with coolants containing abrasives or small chips.

Tanks built especially for Model P-10-⅛ and Model P-30 V-⅛ Pumps can be supplied promptly.

Model P-10H and Model P-30 V pumps are ready for immediate delivery. Phone or wire us for details

FLOYD PENROD & SONS
TOOL & ENGINEERING COMPANY
P. O. BOX 909 Muncie, Indiana

RELEASE SEVERAL MEN FOR ESSENTIAL JOBS with one or more of these NEW type cut-off saws (with the continuous cutting action). They handle 90 per cent of all cut-off work faster and more accurately.

Coolant Model, illustrated, operates at high speeds on any kind of stock, often tripling production and cutting labor in half. Thousands in use in most progressive war plants.

Write or wire at once. Rates a high priority okay.

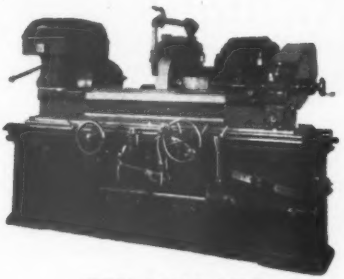
MACHINE TOOL DIVISION KALAMAZOO TANK & SILO CO. KALAMAZOO, MICHIGAN

HILL-CLARKE

Modernized

CYLINDRICAL GRINDERS

for **SUPER-GRINDING** *and* **MICRO-FINISH**



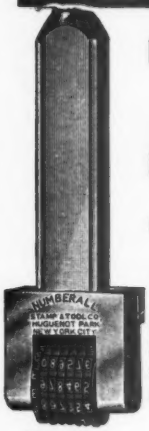
Hill-Clarke Modernized and Motorized Cylindrical Grinders offer refinements in design which minimize vibration and assure extreme accuracy on all grinding operations. One of these refinements, the Hill-Clarke Patented Multiple V-Belt Drive to work spindle, contributes to the smoothness in operation which makes possible a finish within a few micro-inches even when using standard grain free-cutting wheels. Investigate today by sending for a copy of the Hill-Clarke catalog "Super Grinding."

SIZES AVAILABLE

10x28	10x50	14x50	16x72
10x36	10x72	14x72	18x96

HILL-CLARKE MACHINERY CO.
646 WASHINGTON BOULEVARD CHICAGO 6, ILL.

NUMBERALL



NUMBERING MACHINES FOR STAMPING INTO METAL, ETC.

STAMP NUMBERS, etc.
Quickly — Neatly
PERFECTLY ALIGNED

Can be furnished with Shank for Press and with any number of wheels from 3 to 20.

Model No. 70

NUMBERALL STAMP & TOOL CO.
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Try

MOTOR MICA
ANTI-FRICTION COMPOUND

Here is a tried and proved product that will cool hot bearings . . . solve your toughest lubricating problems.

By simply mixing a little Motor Mica with your heavy oils or greases as directed, lubricating properties will be greatly increased. Saves wear on bearings, gears and other moving parts.

Packed in 5-10-25-50-100 lb. Containers

Works Wonders with Cutting Oils

Added to cutting oils Motor Mica saves tools and produces cleaner, smoother surfaces. Gives cleaner draws and reduces upkeep on dies for deep-drawing and punch press operations. A little goes a long way. America's largest industries use Motor Mica regularly.

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Write — Wire — Phone your Order today!

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DIAMONDS *for Victory*

BIG-HED-NIBS
LOC-KEY-SET
RE-SET-ABLE

Cooler dressing
Closer tolerances
Micrometer Accuracy

Because: Wing key heat dissipation and absolute diamond lock nib.

Grinders instruction card free.

● Three grades of diamonds. Common quality $12 per karat. Medium quality $24 per karat. Select quality $48 per karat. (Contour template diamonds supplied only in Medium and Select quality.)

All diamond sizes ½ to 10 karat are nib mounted for immediate shipment . . . Billed subject to approval. Specify quality of diamond wanted. We recommend a minimum size of one karat for each 6" diameter of grinding wheel. (24 hour resetting service, $1.00 post paid.)

The Most Complete and Up-to-the-Minute Line of Diamond Tools for War Production.

Distributed thru Mill Supply Jobbers

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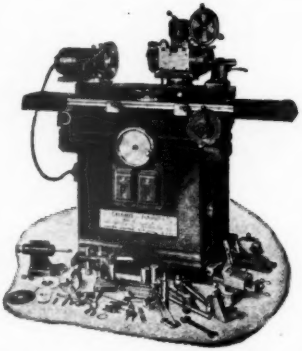
Sheldon M. Booth, Pres.
935 E. 41st Street CHICAGO, ILL.



Grand Rapids No. 6 Universal Cutter & Tool Grinders feature cabinet base, ball bearing table and fixed table height, backed by 35 years of know how.

Bulletin on request

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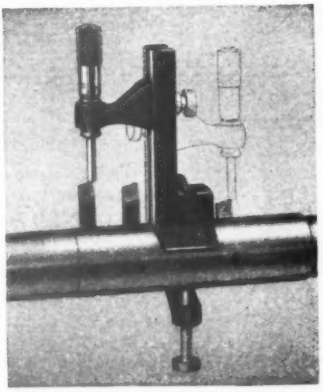
304 Straight Ave., SW
GRAND RAPIDS (4) MICHIGAN

For fast, accurate setting of close-spaced boring tools . . .

BARTELT MODEL "B" PEDESTAL MICROMETER

formerly called Bartelt Tool Setting Gage

★ By reducing the length of the base and by providing slides on both sides of the pedestal, the usefulness of the Bartelt Pedestal Micrometer has been greatly increased with this brand new Model "B". As the illustration shows, tools placed 3½" apart can be adjusted in one setting of the gage, by simply changing the micrometer support arm from one side of the pedestal to the other. Also, the shorter base permits attachment to a bar on which the space between tools is as little as 2". *This gage will speed up boring work because it greatly reduces the time necessary to get an accurate setting of the cutting tools.* As with other models, the base has both flat and vee surfaces so that the Pedestal Micrometer may also be used for a depth gage, a height gage, for inspection, for machine set-ups, and many other purposes. Three clamps are furnished with the gage, to fit all boring bars from 1" to 5" diameter. *Write for Circular.*



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ENGINEERING COMPANY
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BELOIT • WIS.

TWO MACHINES IN ONE FOR DIE FILING
Use Top Table as Shown

FOR PUNCH AND BLIND HOLE FILING
Tilt top table back. Use lower table

ADJUSTABLE STROKE 0" to 1½"
ADJUSTABLE SAFETY FRICTION DRIVE

PRECISION

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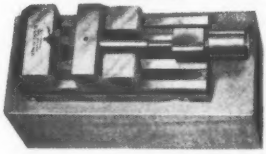

No. 2
TILTS ONE WAY
SAME AS SINE BAR

No. 3
TILTS THREE WAYS

HARDENED, GROUND, LAPPED
Features Include:

1. Precision Sine Rolls
2. Non-Projecting, fully covered, Telescoping Screw
3. Removable Grip Screw Knob
4. Prismatic Slide Jaw
5. Accurate Integral V-Block
6. Tolerance .0002"

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A Complete Manufacturing Plant

AGERSTRAND CORPORATION

Muskegon, Michigan

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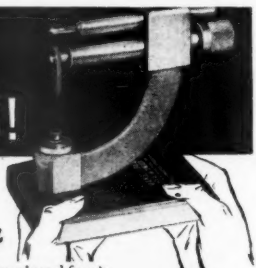
WE HAVE some tapping operations at this plant which are correctly termed as "tough". To meet production requirements we had to make our own taps for the DIFFICULT tapping jobs... That's what put us in the tap business... We offer our service to the industry on the basis of experience.

HIGH SPEED TOOL BITS
another specialty

STOP *Risking* **SKILLED HANDS!**



MAKE-ALL RADIUS DRESSER

Safe in Operation

The hands of your skilled workmen are not exposed to unnecessary accident risks when they use the Make-All Radius Dresser . . . its simple construction and easy operation are designed to keep operator's hands away from the revolving grinding wheel. A time-saver for male and female radius dressing . . . this dresser gives exceptional accuracy without use of depth gauges, micrometer or vernier setting. Priority rating with your order will assure prompt delivery.

ATTACHMENT FOR FULL SEMI-CIRCULAR RADII

Only tool of its kind! Use with Golconda Rattail Diamond Tools to make full semi-circular radii as small as 0.035". Available at small extra cost.

$61.00 RADIUS DRESSER with one 90° GOLCONE Diamond Tool.

$97.50 *Complete* MAKE-ALL with 2 Golcones (60° and 90°), one crystal point, one roughing tool, one Semi-Circular Radii Attachment, and 3 Rattail Diamond tools (1/8", 3/32", 1/16").

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Forgings For All Industries
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Rings, Discs, Blocks, Shafts, Hubs, Bars, and Special Shapes.
Tool Steel of all Makes

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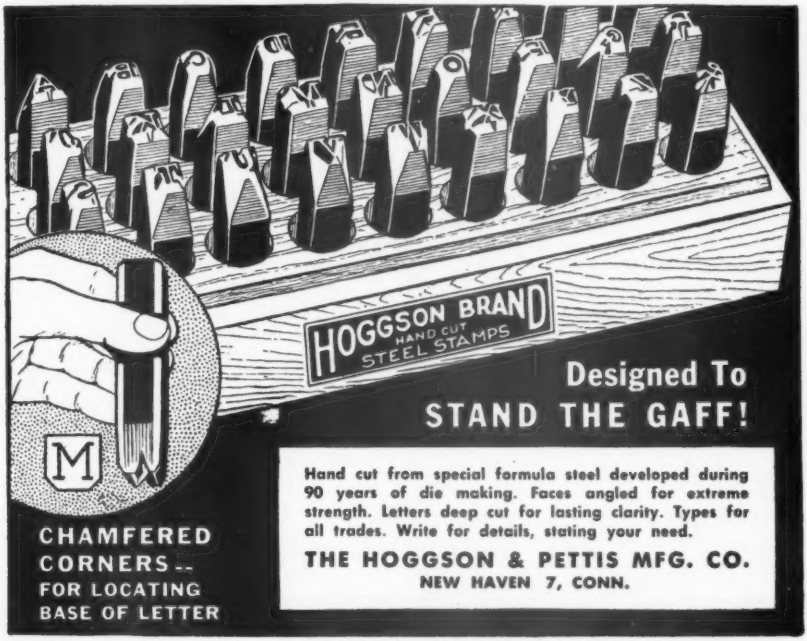
AJAX STEEL AND FORGE Co.
205 ADAIR STREET **DETROIT, MICHIGAN**



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CHAMFERED CORNERS -- FOR LOCATING BASE OF LETTER

Hand cut from special formula steel developed during 90 years of die making. Faces angled for extreme strength. Letters deep cut for lasting clarity. Types for all trades. Write for details, stating your need.

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NEW HAVEN 7, CONN.

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A Tool Room Necessity

Every tool room needs this simple, portable, sturdy demagnetizer. Small parts passed through the powerful AMC field are instantly demagnetized. Large, flat surfaces can be demagnetized by sliding the device over the surface.

Available for either 115 V. or 220 V.

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PROMPT DELIVERY

EASY MOUNTING

Large Quill

4" Travel

(counter balanced, hardened and ground)

6 SPEEDS

250-3000 RPM

Lever and Worm Feeds

½ H. P. Motor

Specially engineered by RUSNOK to meet the demand for heavier duty end mill operations. Uses many types of cutters on a wide range of work. Large size spindle (No. 9 B & S taper). Takes ⅛" to ¾" end mills. Precision Engineered and Ruggedly Constructed Throughout.

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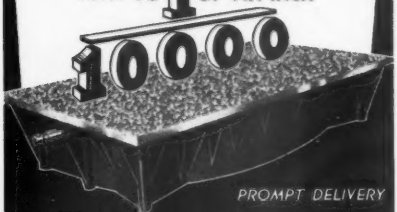
Are they due to Production or Standards?

You Can Rely on

SMITH *MASTER* Surface Plates

FLAT TO 1 OF AN INCH



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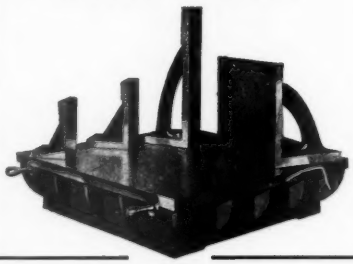
858 N. Wingert St., Bucyrus, Ohio

MILWAUKEE *Surface Plates*



A full line of surface plates, angles and box parallels. Standard plate sizes from 8"x 8" to 48"x 96", larger sizes with or without legs. Plates are finish-planed and scraped to insure a very accurate surface.

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Dust Collector has it.

Model 1250 DUSTKOP (illustrated) and Model 600 are designed especially to save space. DUSTKOPS can usually be mounted behind the dust creating machine, or suspended overhead, or placed under the workbench without interrupting operations. Ideal for small or large grinders and buffers; tool, cutter, surface and internal grinders. Operated by G.E. (or equal) continuous duty motor and fan. Prompt deliveries on high priorities.

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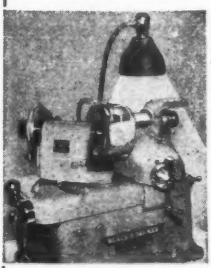
Production Drops



Quality also suffers, errors creep in, man-hours decrease. **Avoid eye fatigue** on close work. Install VIMCO-LIGHTS on Machine tools. Give operators benefit of glareless, softly diffused lighting that reaches those "hard-to-light" places. This is the adjustable light used on so many leading machine tools. Send for circular.

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VIMCO MANUFACTURING CO.

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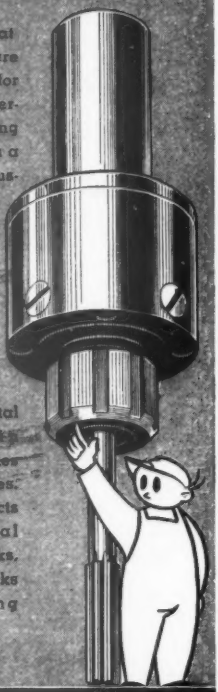
VIMCOLIGHT

The award to Ransome Machinery Company, Dunellen, New Jersey, was the eleventh of the Navy "E", Army-Navy "E" and Maritime "M" Awards won by plants of the Worthington Corp.

UNIVERSAL FLOATING CHUCKS.



Universal Floating Chucks are the ideal tools for drilling, counterboring, reaming or piloting from a lead hole. Adjustable spring pressure compensates for tool weight, allowing increased feed without danger of marred holes. Designed for horizontal operation in screw machines and turret lathes. Write for facts on Universal Floating Chucks, Standard Chucks and Centering Chucks.

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FRANKENMUTH, MICHIGAN

A.C.E. *Special* CUTTING TOOLS HELP YOU MAKE *Production Quotas*

MODERN INSPECTION METHODS

To Insure Accuracy for Your Cutting Tools

Only modern scientific inspection will insure perfect accuracy in the wide variety of types and sizes of special cutting tools we make to customer's specifications. To this end we have organized our inspection department separate from the shop. Equipped with the latest scientific inspection apparatus we have added special inspection apparatus of our own design to guard the accuracy and precision of the tools we ship to our customers.

Send us your inquiries for quick estimates. Bulletin on request. Attractive territories are open for capable agents.

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AMERICAN CUTTER
AND ENGINEERING CORP., WARREN, MICH.
SPECIALIZING IN HIGH SPEED CUTTING TOOLS TO YOUR PRINTS

TO INSTRUCT NEW MEN IN THE HANDLING OF
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we will send you a valuable booklet. No charge, no obligation.

KOEBEL DIAMOND TOOL CO.
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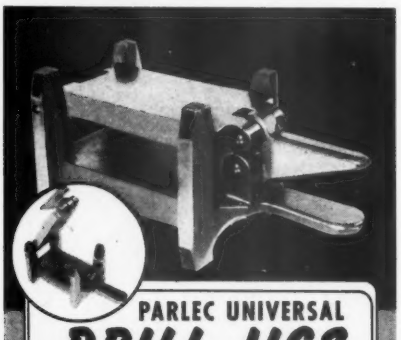
KOEBELITE
DIAMOND TOOLS

Multi-Point, Multi-Set, Multi-Edge and Single Set. Diamonds for all Industrial Purposes.



PARLEC UNIVERSAL
DRILL JIGS
More production with Less Man Hours!
★ *Saves Tool Designers' Time*
★ *Saves Tool Makers' Time*
★ *Saves Production Time*

Made of Nickle Iron normalized with Jig frame and cover finished top, bottom and both sides. Base is not finished. 5 Standard Sizes! Special Sizes and Heights on Request.

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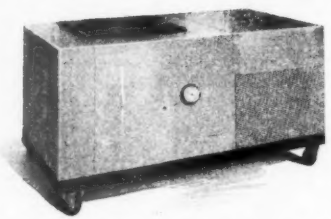
DOES IT BETTER



Stabilization, aging of metals, shrink fits, testing of gauges and tools with KOLD-HOLD Industrial Sub-Zero units assures you accurate, quick and economical processing. Write for authoritative catalog.

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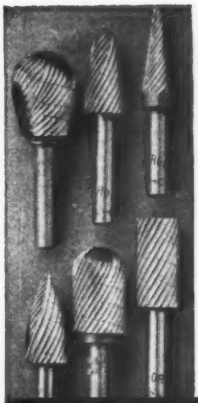

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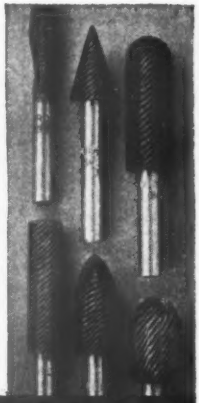
HAND CUT • MILLED CUT
GROUND FROM THE SOLID

There is a GROBET ROTARY FILE in shape, size and coarseness of cut for every type of hard or soft metal, plastic, wood etc. GROBET FILES do their jobs better and stay sharp longer.

Send for catalog YR, the most complete of its kind illustrating and describing GROBET Rotary Files, Diesinkers, Burs, Tube Burring Cutters, Chatterless Countersink, etc.



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IMPORTERS OF GROBET SWISS FILES — MFRS. OF GROBET ROTARY FILES

NEW UNIVERSAL
GREENFIELD
GRINDER SPEEDS
TOOL AND CUTTER
GRINDING

This machine can be furnished either as a plain cutter and reamer grinder, or as a Universal Type. Improved spindle construction, two speeds, attachments and versatility make this grinder a necessity in your tool room. An excellent investment that rapidly pays dividends.

Send for descriptive job application bulletin giving full details.

PRODUCTION MACHINE COMPANY
Greenfield, Mass.

Industry's New Tool . . .

MEAD BURRING MACHINE

It is a time, labor and money saver on innumerable jobs in any shop. De-burrs stamping, forgings, castings; finishes and polishes irregular shapes.

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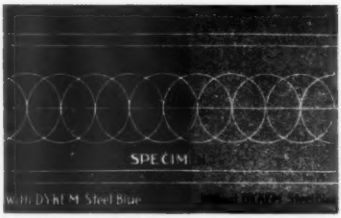

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STOPS LOSSES
making dies & templates

Simply brush on, ready for the layout in a few minutes. The dark blue background makes the layout lines show up in a sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

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from simplest

DIES

to most exacting

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GAUGES — TOOLS — FIXTURES
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BARTH STAMPING & MACHINE WORKS
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IDEAL FOR JIG BORING

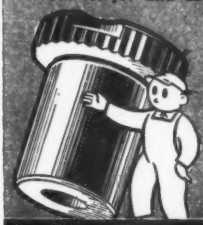
The Hartford Super-Spacer has proven to be useful to most tool rooms for very precise location of work. In addition to use on drill presses, grinders, milling machines, planers and shapers it is used for many jig boring operations. Send for job application bulletin.

THE HARTFORD SPECIAL MACHINERY CO.

General Preference Order E-2-b, covering production and distribution of cutting tools, was revoked by WPB. While the need for these tools still prevails, the controls contained in Priorities Regulation 1 and other WPB regulations will suffice at present.

Universal Drill Bushings Back the Attack!

Universal Drill Bushings are playing an ever-increasing role in America's War Production. Because of their straight and round superfinished bores, Universal bushings save tools, wear longer and assure greater accuracy in all types of drill jig work. Write for complete catalog.



UNIVERSAL ENGINEERING
FRANKENMUTH,
MICHIGAN

EFFICIENCY
for the
PRODUCTION BATTLEFRONT

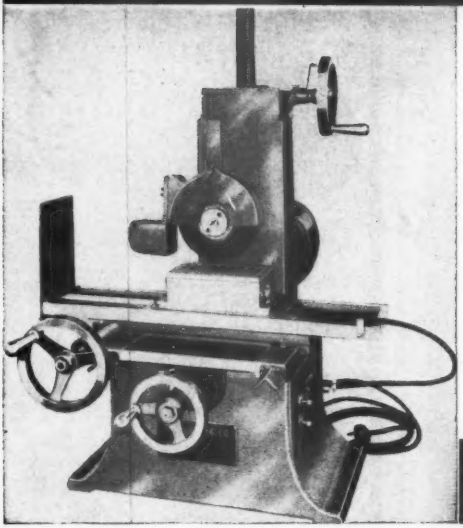
Speed Up Victory with "Oliver"

The tool behind the tool that does the job will help to speed up your production. 100% efficiency can be obtained only with tools that are well sharpened and kept in perfect condition. Speed up production by faster sawing and filing operations with Oliver Die Making Machines. They save 50% to 60% of the labor over hand methods in the cost of making precision Dies, Gages, Cams, Templates and similar products requiring rapid and accurate sawing, filing and lapping operations. It will pay you to investigate the line of Oliver Die Making Machines!

Send for descriptive literature today!

OLIVER INSTRUMENT COMPANY
1436 Maumee St., E. -:- Adrian, Mich.

Sanford precision bench surface grinder



A
HIGH SPEED GRINDER
FOR ALL
SMALL PRECISION WORK

★

Write for
Specifications
Bulletin No. C

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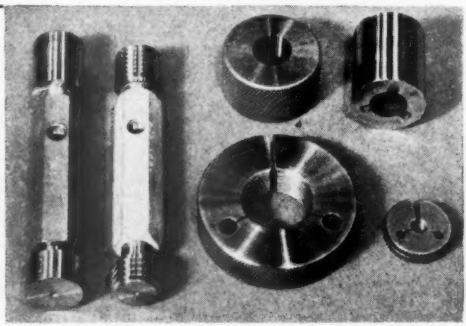
SANFORD MFG. COMPANY
1279-81 SPRINGFIELD AVE., IRVINGTON 11, N.J.

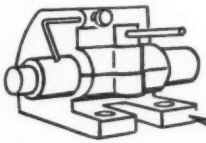
Prompt Shipment OF MERZ STANDARD GAGES . . .



● As one of the four divisions of Merz service to industry, a large stock of standard, plain and threaded, plug and ring gages is maintained at all times for prompt shipment. Special gages, tools and fixtures are made to order; a complete experimental and research engineering service is available; and manufacturing of precision products on contract is done in one of the best equipped plants in this area. Ask for literature "4 Spheres of Service," just off the press.

MERZ *Engineering Company*
INDIANAPOLIS 7, INDIANA

TOOL DESIGN
and MANUFACTURE



SMALL DIES, JIGS
and FIXTURES...
ENGINEERED *and*
BUILT

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MASTER GAUGE CO.
2218 Fenkell Avenue
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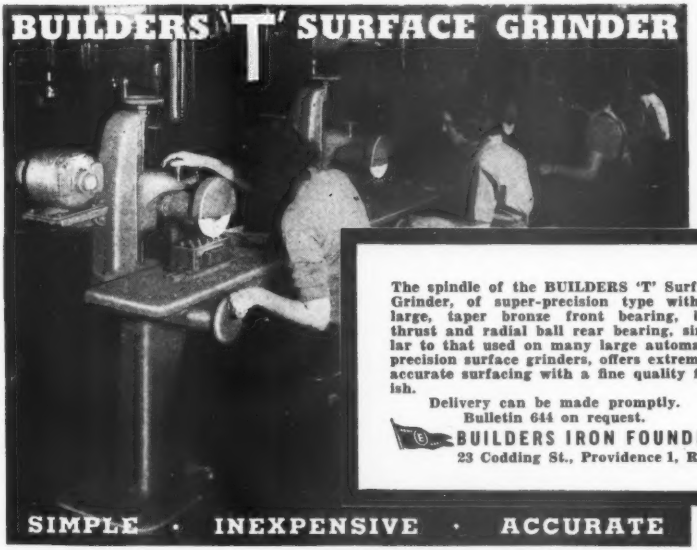
BUILDERS 'T' SURFACE GRINDER



The spindle of the BUILDERS 'T' Surface Grinder, of super-precision type with a large, taper bronze front bearing, ball thrust and radial ball rear bearing, similar to that used on many large automatic precision surface grinders, offers extremely accurate surfacing with a fine quality finish.

Delivery can be made promptly.
Bulletin 644 on request.

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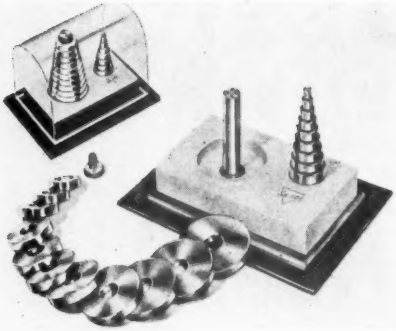
SIMPLE · INEXPENSIVE · ACCURATE

Master Setting and Checking Rolls



SAV-WAY Industries, Detroit, have announced the development of a set of master setting and checking rolls for the accurate checking of micrometers and other precision inspection and gaging instruments.

The set consists of 20 individual rolls ranging from .100" to 2.000" in diameter which are hardened, ground, and lapped to gage makers' X tolerance. They are deep frozen before finish grinding to eliminate internal strains and provide accelerated ageing.

When micrometer anvils have become unevenly worn by long use on one type of work, checking with flat gage blocks is not adequate, as only the high points of the anvils come in contact with the block. This method of checking will obviously result in an inaccurate reading when the micrometer is subsequently used on round work.

Improper checks may also occur when a micrometer has had long use through one particular part of its range so that one section of the spindle is worn more than other sections. In this case, checking the micrometer through any one part of its range might show it accurate, while actually the instrument might be out considerably at the point of greatest wear.

An illustrated instruction booklet on The Use and Maintenance of Micrometers may be had by addressing Sav-Way Industries, Box 117, Harper Station, Detroit 13, Michigan. 16-F

CULLMAN
SPEED
REDUCER
The high speed of electric motors can be stepped down economically with Cullman Speed Reducers to meet the requirements of the slower machine operations. They are made in single, double or quadruple reduction types for motors from 1/3 to 15 H.P. Ratios 1.65 to 1 to 1015 to 1.
Cullman Speed Reducers are compact, durable and efficient. They are equipped with Roller Bearings, Helical Gears, Sprockets, and Roller Chains, all operating in oil. Motor mounting is easy, and when completed makes a single unit that simplifies
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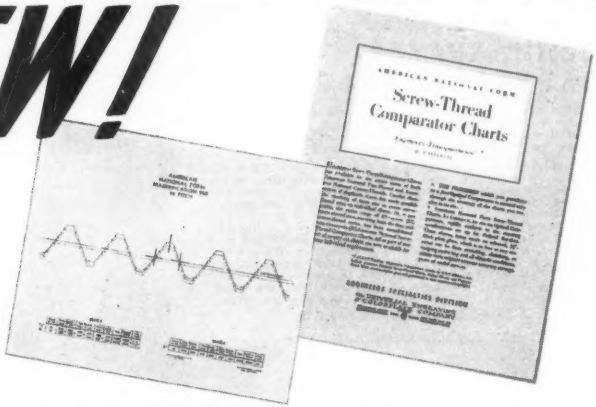

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NATIONAL
NF-2, NF-3
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CHART SIZES
10" x 12" 9¼" x 6¼"
14½" Diameter

FOR use with all types of Comparators, Micro and Measuring Projectors, Universal Screw-Thread Comparator Charts on Ground Glass are now available in complete series covering the entire range of 57 screw-thread sizes, both fine — and coarse-thread series. From one to seven screw-thread sizes can be checked on individual charts. Send for new booklet, illustrated above, showing full details and prices.

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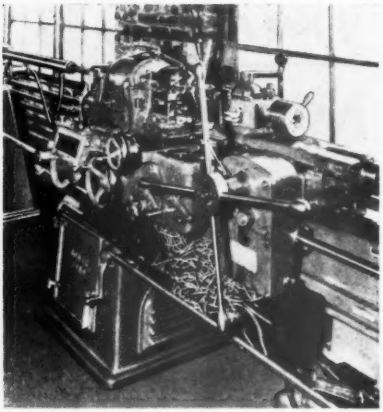

Pnuematic Bar Feed

THE Lipe Pneumatic Bar Feed is a self-contained, automatic, power, stock feeding device for use with machine tools having fixed stops for determining length of work.

All troublesome feed parts (feed fingers, collars, chucks, ratchets, rollers, wobble plates) of screw machines, turret lathes, etc., are eliminated and it feeds without surface contact, preventing mars or scratches on any material. Without set-up change, the Pneumatic Bar Feed will handle all sizes and shapes within the capacity of the machine tool with which it is used. It will feed any distance and hold the stock firmly against stop until the collet is closed. It is especially valuable for feeding polished brass, aluminum, thin tubing, plastics, rectangular shapes, pinion rod, etc.

Another vital feature is the saving of material, avoiding loss due to marred work and short pieces. It also saves time by feeding more rapidly, requires no operator attention and is loaded in a few seconds. Stock is entirely enclosed, leaving no whipping end to catch in clothing, thereby eliminating the necessity of an expensive guard and assuring complete safety.

When the device is attached, the feed finger, feed tube and all parts related to feeding are removed from the screw machine, thus effecting considerable saving in cost of parts and maintenance.

Write for full information on the Lipe Pneumatic Bar Feed to Lipe-Rollway Corp., Dept. J-L, Syracuse, N. Y. 792-F

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A New Low-Cost DURO Quality SHAPER, CARVER, ROUTER

This new three-in-one Router, Carver and Shaper has proven a boom to metal-working shops. It is ideal for routing non-ferrous metals and many other operations. Can be set up for time-saving duplicate routing and veining.

Combines high speed (20,000 R.P.M.) power (1200 watts at the spindle) and solid, heavy construction that gives smooth, vibrationless cutting. Is extremely flexible—can be transformed quickly into a Shaper. Standard equipment handles 1/4", 3/8" and 3/4" bits for routing—7/8" and 1/2" shaper cutters. Has many special features including: Specially designed G. E. Universal Motors, New Departure Precision ball bearings, precision machining throughout; Table can be instantly adjusted to any height without holding foot pedal. Chuck is part of spindle and holds adaptor and cutter extremely close to work thus preventing whip. Many other exclusive features. Unusually low-priced.

Send for DURO CATALOG

Giving full specifications and prices on the DURO Shaper—Carver—Router and other DURO Quality Machines including Drill Presses, Circular Saws, Band Saws, Flexible Shafts, Lathes, Sanders and Electric Drills.

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MACHINE TOOL DIVISION

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Gentlemen: Please send me FREE copy of latest DURO Catalog giving full specifications on new DURO Shaper-Carver-Router and other DURO Machine Tools.

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Designed especially for the profitable handling of small and difficult work on a production basis. Burke Milling Machines are available in sizes Nos. 1, 2, 3 and 4, all motor driven.

Illustrated No. 4 Motor Driven Machine mounted on cabinet column. Write for complete details.

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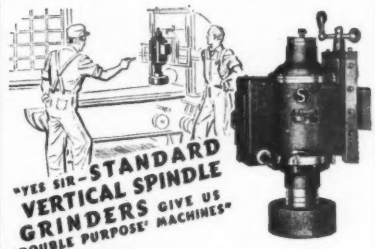

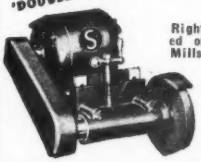

Right—it can be easily mounted on your Planers, Boring Mills, Shapers, Milling Machines, etc. Adaptable for Wet or Dry Grinding.

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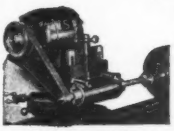

For use on Lathe, Shaper, Planer, Boring Mill, etc. A 2-in-1 Tool—You can grind externally, and in a few minutes mount an interchangeable Quill for internal grinding up to 24" deep.

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for hand tapping of delicate threads, from #0 up to ¼"

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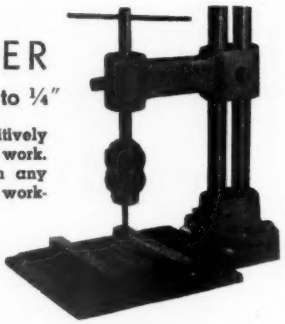


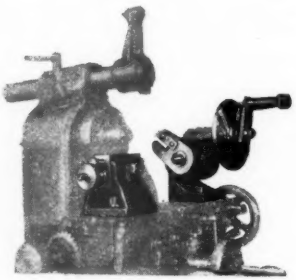
TOOL SPECIALTIES CO.

RAYMOND-COMMERCE BLDG. NEWARK 2, N. J.

Jefferson Dividing Heads

THE Jefferson Tilting Dividing Head has an actual swing of 6". Built to precision, the head stock tilts 5° below horizontal and 5° past perpendicular, hence the swivel is graduated 100°. The worm-wheel is keyed to the spindle to assure positive movement. The spindle has a take-up collar for end thrust, ⅝" hole and No. 7 B & S taper. The spindle nose is threaded USS 1⅛"—12. One-half inch T-slot tongues insure positive and correctly aligned mounting of the head on the machine table. Three indexing plates divide all numbers to 50 and all even numbers to 100. The plates cover the entire range of the B&S index chart. The head is usually furnished right hand as pictured; left hand mount if desired.

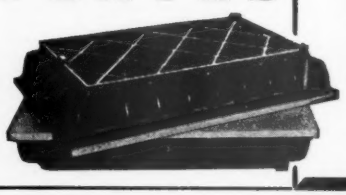
The 7½" Swivel Base Dividing Head has a capacity for 7½" diameter work and swivels 360° in a horizontal plane marked by 1° graduations. The index operates by means of worm and worm gear of 40:1 ratio. Index plates provide divisions from 1 to 20; even divisions from 50 to 100, plus 55, 65, 75, 85, 95; all other divisions to 360 shown on the



index table. A direct index plate gives 2, 3, 4, 6, 8, 12 and 24 divisions.

Jefferson Machine Tool Co., 710 N. Fourth St., Cincinnati, O., will supply further details. 685-F

REID MASTER PLATES



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With HOLDING Fixture for Bench Grinder

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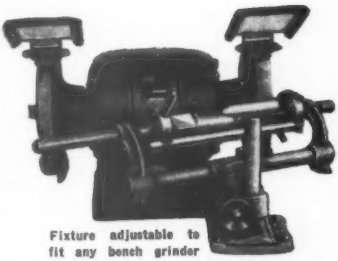

Fixture adjustable to fit any bench grinder

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The smaller, the more precision you need in your drilling. Holes from .004 to .250″ in diameter require extraordinary perfection . . . and that's what the HAMILTON DRILLING MACHINE supplies.

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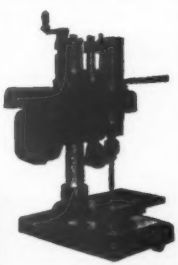

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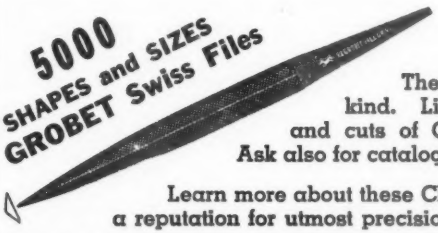

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Large Jigs, Fixtures and Special Machinery. Prefer man with designing, practical and executive experience. Well established tool and die plant in Detroit. Excellent conditions and salary. Permanent position with wonderful postwar future for the right man. Must be eligible under WMPC. All replies confidential. Include experience, qualifications and age.

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TOOL & DIE JOURNAL

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Cleveland 6, Ohio

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CAPACITY:
3/8" to 2½" drills.
5" x 9" adjustable table.

MOTOR: ½ hp, 3450 rpm.

NET WT: 250 lbs.

CRATED: 320 lbs.

PRICE: $150.00.

McDONOUGH MANUFACTURING CO.
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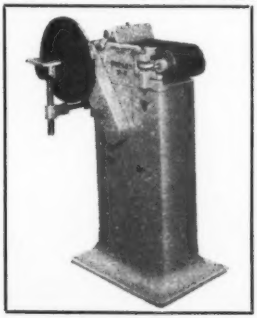

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The latest in pedestal type grinders. Actually two machines in one! 14" disc for all rough work . . . 6 x 48" band for finishing. Precision-built to meet wartime production standards — quickly, economically!

Other styles and sizes in New Booklet on Finishing—Write Today

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GIVE YOUR WORK A LIFT WITH

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Capacity
up to
20
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PORTELVATOR
(Portable Elevating Table)
Save precious time, unwelcome expense, unnecessary effort. Lift, carry, support . . . PORTELVATOR can be all things to all industry.

THE HAMILTON TOOL CO.
Ninth and Hanover Streets.
HAMILTON OHIO

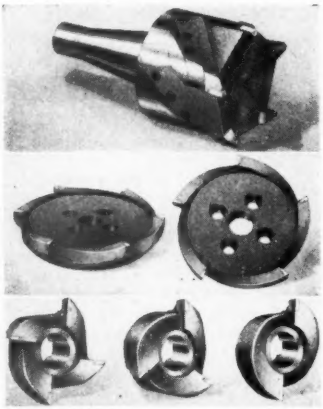
Carbide Tipped Tools

"CAL-CUTTERS" is the trade name for the various types and sizes of carbide tipped tools now being manufactured by Machinery Manufacturing Co., of Los Angeles, manufacturers of the Vernon line of machine tools. Standard cutter styles include end mills, staggered tooth mills, half side mills, slitting saws, inter-locking cutters, etc.

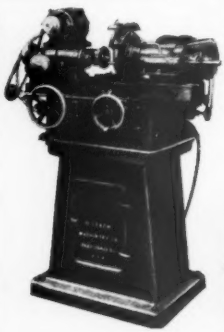
Bore face mills and adjustable face and step mills are examples of Cal-Cutters novel design. In each of these types, the cutters are adjustable for radius; in the former they are wedge clamped and available with two, three or five tips. The adjustable face and step mill possesses four or six tips in two models, each tip being controlled by a micrometer screw.

Cal-Cutters are designed for the efficient milling of cast iron, cold rolled steel, heat treated steel, aluminum, dural, etc. Characteristic of Cal-Cutters is the smooth, chatter free performance with minimum expended power.

Special cutters can be made on special order.



Copies of the Cal-Cutter catalog showing all standard types will be sent on request by Machinery Manufacturing Co., 1915 E. 51 St., Vernon, Los Angeles, Calif.



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Grinds Work from 3/4" to 11" in length and from 1/8" to 7" in diameter

PRICE $985.00 Fully Equipped

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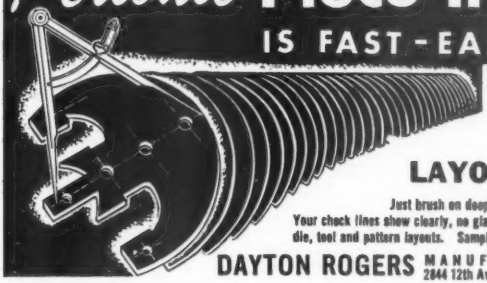
Agents in all Principal Cities Throughout the World

Periodic Piece Inspection
IS FAST - EASY - ACCURATE



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Just brush on deep Dio Blue. Dries at once. Your check lines show clearly, no glare. Also used for original die, tool and pattern layouts. Sample on request.

HANDY 4 oz. Brush-in-can	.40
PINT	.80
QUART	.90
GALLON	$2.50

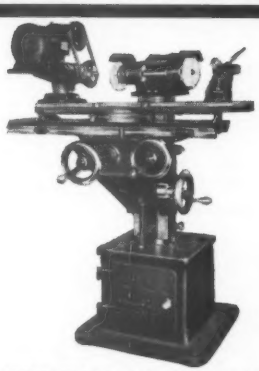
DAYTON ROGERS MANUFACTURING CO.
2944 12th Ave. S., Minneapolis 7, Minn.

War Plants' Labor Turnover Increasing

The Office of War Information recently reported that the nation's major war plants are finding it necessary to hire 17 workers monthly to get a net increase of three for every 100 employed. The OWI report was based on information from the War Manpower Commission and the Labor Department Bureau of Labor Statistics. As for manufacturing as a whole, latest figures show that workers are not being hired fast enough to replace those leaving industry.

While much of the turnover is justified and some of it is in the interest of the war effort, the present excessive rate must be substantially reduced or the whole pattern of war production will be jeopardized. With the nation exhausting its supply of available new manpower, it is necessary to utilize fully all available labor. The elimination of labor hoarding and waste, and the reduction of remediable turnover are steps that can make the greatest progress toward maximum utilization.

STERLING TOOL GRINDER



SPECIFICATIONS: 10″ swing; 22″ between centers with work head and 26″ with L. H. tailstock; table 5″ wide, 36″ long; 23″ maximum table travel; 8″ cross feed; 8″ vertical movement; table swing around column, 180 degrees in each direction. *Prompt delivery with priority.*

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brings out the best in cutting fluids!

For All Cutting Fluid Problems
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Warehouses in *Principal Metal Working Centers*

HAMILTON
SWISS TYPE
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...for accuracy and speed in hobbing

PINIONS, GEARS *and* **SECTORS.**

TWO MODELS

No. 00 SPUR GEAR HOBBER (Illustrated) for work up to 2" diameter.

No. 1 SPUR and SPIRAL GEAR HOBBER for work up to 6" diameter.

Write for further details to

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MACHINE TOOL CORP.
Exclusive Sales Agents
127 Barclay St.,
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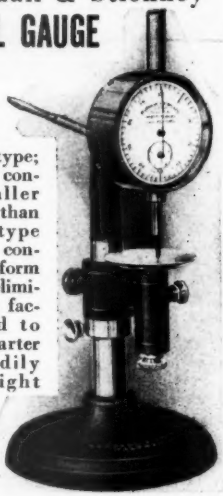
Manufactured by
The Hamilton Tool Co.
HAMILTON, OHIO

The Randall & Stickney
UNIVERSAL GAUGE

½" and 1"
CAPACITY



Rack and pinion type; simply, strongly constructed; smaller number parts than any similar type gauges. Spring control insures uniform light pressure, eliminating personal factor. Graduated to .001" (one-quarter thousandth readily estimated). Height 9¾", weight 5 lbs. 1¼ oz.

½" - $35.00
1" - 40.00

FISHER TOOL COMPANY
226 Lafayette St. New York 12, N. Y.

ARMSTRONG
SETTING-UP TOOLS

This is no time for machines to stand idle, while good tool makers rummage through the scrap heap for setting-up materials or waste vauable time fashioning makeshift setting-up devices. Equip all planers, shapers, milling machines, drill presses and special machines with ARMSTRONG SETTING-UP TOOLS—Planer Jacks, Bracing Jacks, "T"-Slot Bolts and Drop Forged Strap Clamps that reduce setting-up time to a minimum, hold work and jigs rigidly, prevent delays, accidents and spoilage and stand up for years.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
340 N. Francisco Ave., Chicago
Eastern Warehouse & Sales:
199 Lafayette St., New York

Write for Circulars

LUFKIN
SAGINAW, MICHIGAN · NEW YORK CITY
TAPES · RULES · PRECISION TOOLS

YOU GET MORE HOLES PER **MAN-HOUR . . .**

. . . when you use patented Dual-Spiral Evans High-Speed Steel Expansion Reamers. They finish ream magnesium, bronze, iron, aluminum, or steel alloys, fast and accurately. Spiral blades rotating in opposed directions at the same time, ream smoothly over keyways and split bushings. Straight line expansion from .035" to .080" makes Evans Reamers last as high as 100 times longer than ordinary one piece reamers.

- Eliminates Honing
- .035"to .080" Straight Line Expansion
- Extensions and Pilots for Line Reaming
- No. 1 to 5 Morse Taper Shanks Available
- Butt Shank Available for Turret Lathe
- Taper Bushing Available for Line Work

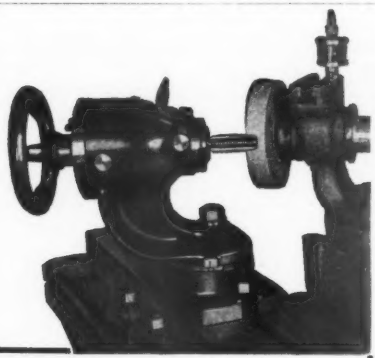
EVANS REAMER & MACHINE CO.
4541 RAVENSWOOD AVE., CHICAGO, ILL.
Established 1910

SAVED—850,000 Pounds of TIN!

More than 850,000 pounds of tin have been saved by the General Electric Company in the 23 months since Pearl Harbor as a result of changes adopted by the company in its solders and babbitt alloys. Calculated in terms of No. 2 food cans, tin-plated both sides in accordance with today's WPB regulations, this saving corresponds to the amount of tin on about 825,000,000 such cans—cans enough to fill many a pantry.

War had hardly been declared before General Electric engineers began to investigate the possibilities of solders containing less tin. Thus, the first tin-conservation order, put into effect by the War Production Board on December 31, 1941, found General Electric already at work on tin conservation. Solders before the war were high in tin content,

(TO PAGE 210—PLEASE)



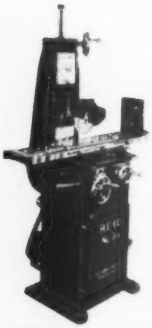
HYBCO CHAMFER SHARPENING HEADS

For Universal Tool & Cutter Grinders

Grind ACCURATE ECCENTRIC RELIEF on CHAMFERS of TAPS —COUNTERSINKS—CORE DRILLS — STEP DRILLS — Similar tools with evenly spaced flutes.

Write for Circular CH

HENRY P. BOGGIS & CO.
1277 W. Third St., Cleveland, O.



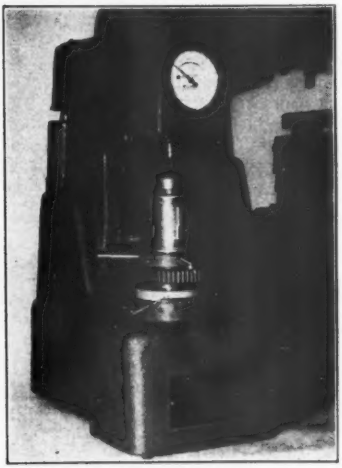
REID *Automatic Feed*
Surface Grinder No. 2A
A Proven Product for Over a Quarter Century with Thousands in Use Daily.

PRICE $790.00 F.O.B. Less Motor

Send for Descriptive Literature
EXCELLENT DELIVERIES
Our dealers will help you fill out necessary priority forms. Write us today for your nearest dealer's name and address.

Exclusive Selling Agents
H. LEACH MACHINERY CO.
387 CHARLES ST. PROVIDENCE, R. I.
Agents in all Principal Cities Throughout the World

"ROCKWELL"
HARDNESS TESTER



Shipment in One Week
Wilson Mechanical Instrument Co., Inc.
383 Concord Ave. New York 54, N. Y.

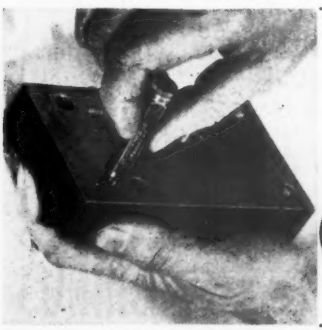
Large Industrial Advertiser Uses "Basic English"

ONE of the first of the large industrial concerns in the United States to use Basic English in the preparation of their international advertising program is The Lapointe Machine Tool Company of Hudson, Massachusetts.

This company has a branch factory in Edgware, Middlesex, England, and had, before the war, representatives in practically every country of the world. It has pioneered in many types of international advertising approach. On page 33 of this issue is the Lapointe advertisement for this month which in its pure translation reads as follows:

TOOLS FOR TODAY AND TOMORROW

Head and shoulders above the vast array of tools on the production front is today's high speed broach. For metal removing, continuous contour, both internal and external shaping, the broach in answering today's armament production requirements and points to a future of even greater precision, greater production and greater versatility—to a future which will see better consumer goods and greater indutsrial development throughout the world.



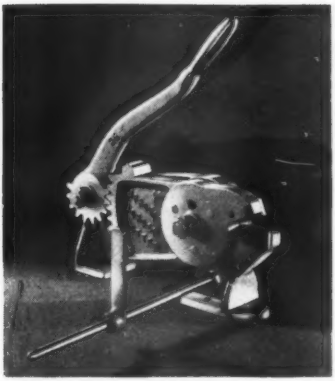
A REAL HELPING HAND

It's a help that die makers, tool makers, machinery builders and general machinists have long sought—a more accurate and surprisingly faster way of transferring blind screw holes.

The Heimann Transfer Screw Set is a self-contained, complete tool. No wrenches or pliers are necessary. Made in ¼" to 1" diameters.

Send for price list.

HEIMANN MFG. CO.
Dept. T
Urbana, Ohio



The Newest in Cutters

THE WONDER:
CUTS—Wire and Rods up to ⅝ in.
CLIPS— Band iron up to ⅛ x 2 in.
MEASURES— Length of pieces.

The lowest priced wire and band cutter on the market. Every Shop, big or small can use a WONDER CUTTER.

Write today for further information and prices.

THE FEDERAL FOUNDRY SUPPLY CO.
4608 East 71st St., Cleveland, Ohio

M & L PRECISION TAPPER

Taps guided by precision leads. Class 3 & 4 specifications easily met. 4 speeds. Ball Bearings throughout. Available as floor model (with coolant system) or table model; also automatic air stop for bottom tapping.

International Inside Micrometers

Highest accuracy and finest workmanship. Available 1½"—6" & 1½"—12" sets.

Brand Telescope Gages ½" to 2⅛"
Handy Knurler, usable drill press or lathe.

BRAND TOOL & SUPPLY CO.
Flower at Washington Los Angeles 15, Cal.

HY-TEN
AISI SAE
NE

Alloy Steels For Offense

Scientifically selected to conserve critical alloys and meet the requirements of the AIRCRAFT, ORDNANCE, and MACHINE TOOL industries.

Complete "EARMARKED" stocks of Aircraft alloy steels at Buffalo and Detroit.

WHEELOCK, LOVEJOY & CO., INC.
138 Sidney Street
CAMBRIDGE, MASS.
Cleveland, Chicago, Newark, Detroit, Buffalo, Cincinnati

Columbia TOOL STEEL

NEED HELP?

There is a Columbia man near you and ready to help with every tool steel problem.

Call him if he can help.

BUY WAR BONDS

It pays to use Good Tool Steel

COLUMBIA TOOL STEEL COMPANY

New Nesting Type Tote Pans

20" long x 12" wide x 6½" deep.
16 ga., drag holes and handles both ends.

J. L. LUCAS & SON, INC.
Bridgeport, Conn.

DIX

PRECISION MADE AND AVIATION TYPE UNIVERSAL JOINTS

15 STANDARD SIZES

AIRCRAFT AND MARINE SPECIALTIES
COLLET CLOSERS
LATHE STOPS
UNIVERSAL JOINTS, ETC.

Precision made (and we do mean "precision") from ⅜" to 4" Hub Diam. to Army, Navy, Air Corps spec. AN-40236 ready to install. ⅜" to 1" sizes in stock. Increase Lathe Production with Dix-Wilder Automatic Collet Closers and Multiple Carriage Stops. Immed. Delivery. Write, wire for detail, data, etc.

DIX MANUFACTURING COMPANY
603 EAST 55th ST. LOS ANGELES, CALIF.

NEW

GLASS SURFACE PLATES

Afford unique advantages. Priced from $11 to $90. Write for folder.

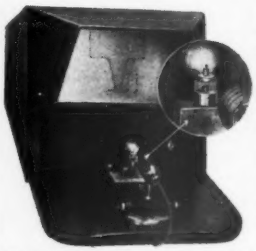
CADILLAC GLASS CO.
900 West Cermak Road
Chicago 8, Illinois

(CONTINUED FROM PAGE 207)

most formulas calling for about half tin and half lead. Pure tin was employed for many jobs. During 1942 the WPB limited solders to a maximum of 30 per cent tin except for certain applications, and this year limits tin content to 20 per cent in solders for general work.

Lead-base babbitt has replaced tin-base babbitt with no change in bearing design and it carries the same unit loads on pressure as did the tin-base babbitts.

THE YOUNGS PROJECTOR GAGE



The point pin illustrated on the screen is set to gage ten dimensions at one time. Permits taking advantage of the full allowable tolerances. Insert shows inexpensive holding fixture. No high priced gages to wear out. Simple to load at high speed.

Multiple Gaging. One to twenty dimensions in one operation. Possible production of 1200 pieces per hour.

PRICE $200.00 F. O. B., NEW YORK CITY. Screen layout and holding fixture. Quoted on application.

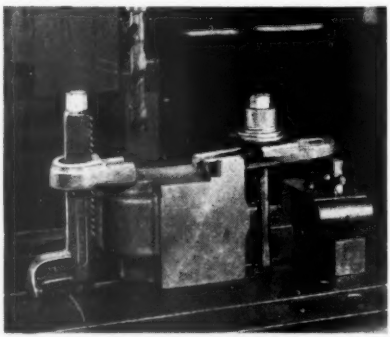
WOODEN CABINET SPECIFICATIONS
Height 19"—Width 18"—Length 42"

STANDARD MAGNIFICATION
Adjustable to 20-25-30

USEFUL SCREEN SPECIFICATIONS
Height 12"—Width 15"

Operates on 110V. A.C. Equipment for other currents available upon request.

MANUFACTURED BY:
ADROIT MANUFACTURING CO., INC.
92 WARREN ST. NEW YORK, N. Y.



NEW WAY ↑ ↑ OLD WAY

SPEAKS FOR ITSELF

Howell "high speed" adjustable work clamps save time, trouble and worry. Why risk tool breakage, job spoilage or injury by using makeshift methods? Send for descriptive literature describing these unique clamps.

HOWELL CLAMP COMPANY
1373 East 95th St., Cleveland, Ohio

Changing your address?

Please report change of address to The Tool & Die Journal, allowing four weeks for the change to take effect Be sure to send your old address together with the new one To receive your book promptly please include your postal number Notify us in advance and avoid missing your copies

WE INVITE YOU TO TRY

CRATEX

WHEELS AND POINTS

The World's Best Rubberized abrasives for Fine Grinding and Polishing

Attach this advertisement to your card or letterhead. We will send you a *free* trial sample. Or if you prefer send $1.00 for Special 33 wheel assortment.

CRATEX MFG. CO. 81 Natoma Street San Francisco - Calif.

NEW CALIPER

SPEEDS UP DEFENSE WORK

Direct Reading Accurate, Fast, Simple. New timely tool SAVES TIME, SPEEDS UP PRODUCTION. Graduated scale, easily read at a glance. Adaptable to all types, shapes of work, wood or metal. Measures 0 to 4 inch.

FREE LITERATURE and PRICE on request

T & H MFG. CO.
811-L East 31st, K. C., Mo.

HANDY RACKS

Now available in 4-Arm, 51" high or the new 5-Arm-Rack, 57" high. Used wherever flat or round bar stock or tubing is kept—factories, warehouses, schools, large & small shops. Four times the usual capacity for the floor or height space. Low cost, & money or space saved.

Send for priced circular.

Priority Regulations Govern Delivery

Wm. S. Yohe Supply Co.
507 Gibbs Ave., N. E.
CANTON 4, OHIO

SEND US YOUR PRINTS FOR *Quotations*

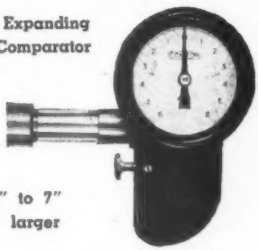
THREAD GRINDING
BROACHING
MAGNETIC INSPECTION

TAYLOR MACHINE COMPANY
MANUFACTURERS OF
AVIATION & AUTOMOTIVE PARTS
Gear Specialists
1917 EAST 61ST ST. • CLEVELAND 3, OHIO

Gaging to fractions of .0001" by relatively unskilled workers

COMTORPLUG

Patented Expanding Internal Comparator



Sizes: ¼" to 7" dia. and larger

"Makes trainees master gagers." By automatic features of self-centering and self-alignment, this unique comparator gages precision bores to fractions of .0001", detecting out-of-round, front or back taper, bell mouth, barrel shape, etc. Widely used in airplane, automotive, and ordnance fields.

REQUEST BULLETIN 29

THE COMTOR CO.
82 Rumford Ave. Waltham, Mass.

Be 100% with your

10%

Buy

WAR BONDS

Modern facilities for designing and building Precision Tools—Dies Jigs Fixtures—Molds—Gages—Special Machines—Precision Specialties. Also, shops equipped to provide Stampings—Forgings—Castings—Plastics—Grinding—and similar contract services.

HARTFORD, CONNECTICUT

***HARTFORD SPECIAL MACHY. CO.**
281 Homestead Avenue
SPECIAL MACHINES
Gears—Cams—Precision Specialties

BELLEVILLE, ILLINOIS

DRESEL-BETZ COMPANY
Belleville, Ill.
Designers and Manufacturers of
Tools, Dies, Jigs, Fixtures, Metal Stampings

CHICAGO, ILLINOIS

PRESS BRAKE DIES
AND PUNCHING
ATTACHMENTS for ALL
MAKES of PRESS BRAKES
DREIS & KRUMP MFG. CO.
7428 S. Loomis Blvd. Chicago 36, Ill.

***FEDERAL TOOL CORPORATION**
400 North Leavitt St. HAYmarket 2150
Tools Dies Jigs Fixtures
Stampings Special Machinery

ROCKFORD, ILLINOIS

ROCKFORD DIE & TOOL WORKS, INC.
1816 Seventeenth Ave. Phone Main 3084
Rockford, Illinois
Designers and Manufacturers
TOOLS—DIES—JIGS—FIXTURES
PRODUCTION JOB WORK

DETROIT, MICHIGAN

DAVIS TOOL & ENGINEERING COMPANY
19250 Plymouth Rd. VErmont 5-6000
Tools and Dies Special Machinery
Sheet Metal Stampings and Assemblies

***ENTERPRISE MACHINE PARTS CORP.**
2731 Jerome Avenue TWinbrooke 1-7900
EMPCO Drilling, Milling and Tapping Units
EMPCO Machine Levelling Jacks
Production Machine Repair Parts, Tools and Fixtures
Single Purpose Machine Specialists

***MAJESTIC TOOL & MFG. COMPANY**
2946 Woodbridge St., East FItzroy 1011
Manufacturers
General line of Tool and Die Work, Tool Details, Parker High Speed Grinding Spindles

ROBBINS ENGINEERING COMPANY
318 Midland Ave. TOwnsend 8-9650
Designers and Manufacturers
Tools, Dies, Jigs, Fixtures
Special Machinery and Experimental Work

ROYAL OAK TOOL & MACHINE CO.
621 E. Fourth St., Royal Oak, Mich. Elmhurst 6580
Manufacturers of
Tools, Dies, Jigs, Fixtures. Special Machinery and Designing. Hoch Self-Centering Cylinder Reamers

MUSKEGON, MICHIGAN

* TOOL DESIGNING
PROCESS ENGINEERING
MACHINE DEVELOPMENT
AGERSTRAND CORPORATION
Engineering Division
Muskegon, Michigan
Detroit Office—1900 E. Jefferson Ave.
Phone: Fitzroy 2575

***See larger display advertisement also.**

BELLEVILLE, NEW JERSEY

THE VIKING TOOL & MACH. CORP.
6 Main St. Belleville, N. J.
Tools—Dies—Jigs—Fixtures—Molds—Gages
Machines—Stampings—Specialties

JAMESTOWN, NEW YORK

RANE TOOL CO., Inc.
17 Ross St. Phone 5934
Specialists In
Blanking, Forming and Drawing Dies

NEW YORK, NEW YORK

CONRAD & MOSER
2-23 Borden Ave. Long Island City, N. Y.
Machine Tools & Molds, Parts & Machines
Aluminum Cast Parts—Aluminum Sheet
Formed Housings

CLEVELAND, OHIO

***BARTH STAMPING & MACHINE WORKS**
Die & Tool Makers
W. 34 & Denison Fl. 8411

***THE BUNELL MACHINE & TOOL CO.**
Designers and Manufacturers
1601 East 23rd St. CHerry 0343
DIES—JIGS—FIXTURES
Gages—Models
SPECIAL MACHINERY
Swiss Jig Boring
Screw Machine Products
Complete Engineering Facilities

CLEVELAND UNIVERSAL JIG COMPANY
13404 St. Clair Ave. MUlberry 2600
Designers and Builders
Jigs & Fixtures Special Machines
Production Engineering
COMPLETE PLANT ROUTING and TOOLING

THE DENNING MANUFACTURING COMPANY
1775-81 East 87th St. CEdar 0801
Designers and Builders
HIGH GRADE DIES

GENERAL DIE & TOOL COMPANY
2067 W. 55th St. WOodbine 4736
Dies Tools Jigs Fixtures
Light Stampings Manufacturing Special Machinery

THE INDUSTRIAL MACHINE CO.
1436 East 47th Street Founded in 1903
Builders of Special Machinery
GENERAL MACHINE WORK

KIFFER TOOL & DIE CO.
5601 Tillman Ave. WOodbine 2440-2441
Manufacturers Special Machinery
Tools, Dies, Jigs, Fixtures, Tungsten Carbide Tools
SWISS JIG BORING

THE LORAIN MACHINE & TOOL CO.
1951 West 90th St. MElrose 5010
Designers and Builders
Dies, Jigs, Fixtures, Gages
Special Machinery, Jig Boring

***THE McKINNEY TOOL & MANUFACTURING CO.**
1688 Arabella Rd. KEnmore 1681
Designers and Builders
Jigs—Fixtures, Dies, Special Machinery
Swiss Jig Boring General Machine Work

NOBLE & STANTON, Inc.
998 Broadway Bedford, Ohio
Bedford 1234
Tool Makers
Specialists in Aircraft Work

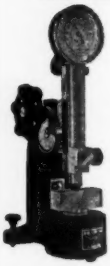
PARAMOUNT TOOL CO.
1392-98 East 43rd St. ENdicott 2220
JIGS, FIXTURES, DIES
Experimental Work

The PHOENIX MACHINE COMPANY
2711 Church Ave. CHerry 1048
CONTRACT GRINDING
BORING and PLANING
LESTER-PHOENIX DIE CASTING
AND PLASTIC MOLDING MACHINES

A. P. SCHRANER & COMPANY
3338 Payne Ave. HEnderson 8644
EXTERNAL CYLINDRICAL
LAPPING MACHINES
Special Machinery
TOOLS, DIES, JIGS, FIXTURES

*See larger display advertisement also.

HARDNESS TESTING



has been done with the
SCLEROSCOPE
since 1907

●

THE SHORE INSTRUMENT & MFG. CO., INC.
9025 Van Wyck Avenue
Jamaica, N. Y.

Gusher
COOLANT PUMPS

Sizes from 1/10 to 2 h. p.
Pumping capacity up to 200 g.p.m. Many patented and exclusive features.
Write for descriptive literature
The Ruthman Machinery Co.
1808 Reading Rd., Cincinnati, Ohio

CONTRACT SHOPS

(Continued from Page 213)

CLEVELAND, OHIO

*THE SOMMER & ADAMS CO.
18511 Euclid Ave. KEnmore 0810-0811
DESIGNERS AND BUILDERS OF
Special Machinery
TOOLS JIGS FIXTURES
The Cleveland No. 1 Vertical Milling Machine

STAR MACHINE & TOOL COMPANY
9320 Woodland Ave. GArfield 2060
Designers and Builders
Dies, Jigs, Fixtures, Gages, Special Machinery
Jig Boring—Planer Equipment

*TOOLS & GAGES, Inc.
3112 East 63rd St. MIchigan 7230
"Let us be your tool room."
DESIGNERS AND BUILDERS
Tools, Gages, Dies, Jigs, Fixtures
Special Machinery
Swiss Jig Boring - Die Casting Dies

THE VARIETY MACHINE & STAMPING COMPANY
12695 Elmwood Ave. LAkewood 8433
Designers and Manufacturers
Dies, Metal Stampings 250 tons capacity

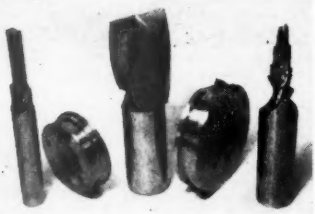
HAMILTON, OHIO

*THE HAMILTON TOOL COMPANY
Ninth and Hanover Streets
Designers and Builders of
Tools, Dies, Jigs, Fixtures, Special Machinery
The Hamilton Portable Elevating Table

*See larger display advertisement also.

The second Army-Navy E award has been granted to the men and women of The Schauer Machine Co., Cincinnati, Ohio, for continued excellence in war production. The first award was made in October, 1942. A star was added to the flag in September, 1943.

SPECIAL FORM TOOLS
FOR ALL PURPOSES



TOOLTHRIFT COMPANY
1245 WASHINGTON BLVD. · PITTSBURGH

METAL INDENTING MACHINE

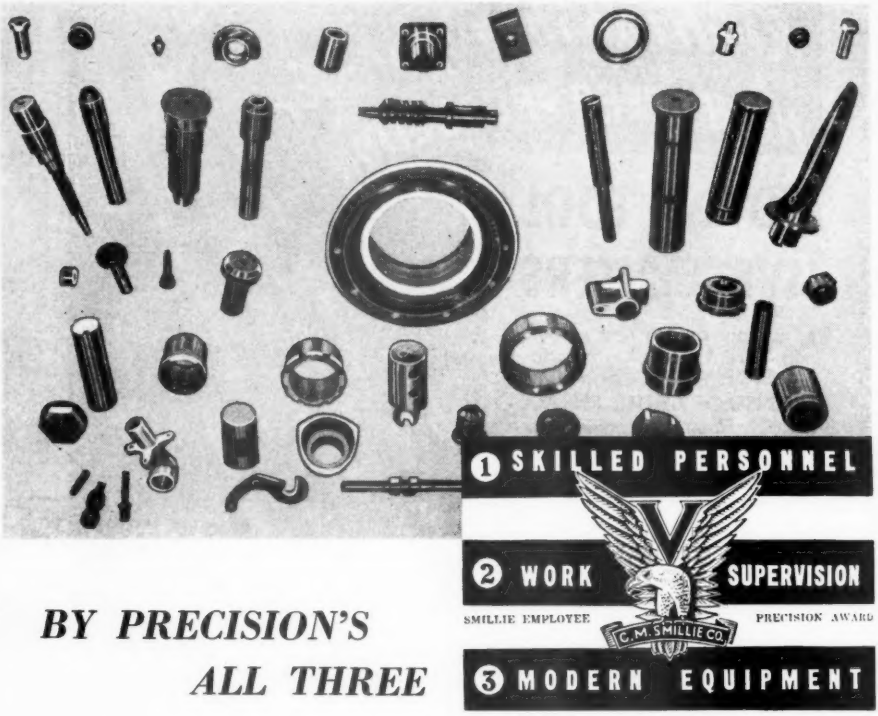
Hand Lever Press illustrated is fitted with an automatic Numbering Head for indenting serial numbers or lot numbers in metal parts.

For Indenting and Embossing Machines, Steel Stamps, Numbering Heads, send for Catalog H.

MARKING EQUIPMENT
ADOLPH GOTTSCHO, INC.
190C DUANE ST. NEW YORK 13 N Y

RIGHT to the Point—for
HIGH SPEED PRODUCTION
MOTOR TOOL
LIVE CENTERS
Ball and Roller Bearing
effectively put an end to burn-outs—breakdowns—work spoilage — AND THE CONTINUOUS EXPENSE OF CENTER REPLACEMENTS. Their outstanding performance on high speed war production is convincing proof of how they can save for you.
Write for descriptive folder
THE CENTER OF ATTRACTION
BUY UNITED STATES WAR SAVINGS BONDS STAMPS
MOTOR TOOL MANUFACTURING CO.
METAL CUTTING TOOLS
7783 CORTLAND AVENUE · DETROIT, MICHIGAN
Make it a Rule to Call Motor Tool

THIS IS PRECISION . . . .



BY PRECISION'S ALL THREE

An increasing volume of high precision parts for aircraft, ordnance and ammunition is being produced in the modern plant of The Smillie Company. The "All Three" basis of Smillie craftsmanship and precision assures this type of performance for today and tomorrow, as it did yesterday, in 1889, when Smillie developed Detroit's first precision tool shop. Whether your requirements be armaments or post war products Smillie is a dependable source for precision parts.

C. M. SMILLIE & CO.

1108 WOODWARD HGTS., FERNDALE, MICH.

PRECISION ◆ YESTERDAY ◆ TODAY ◆ TOMORROW

Quick Delivery!

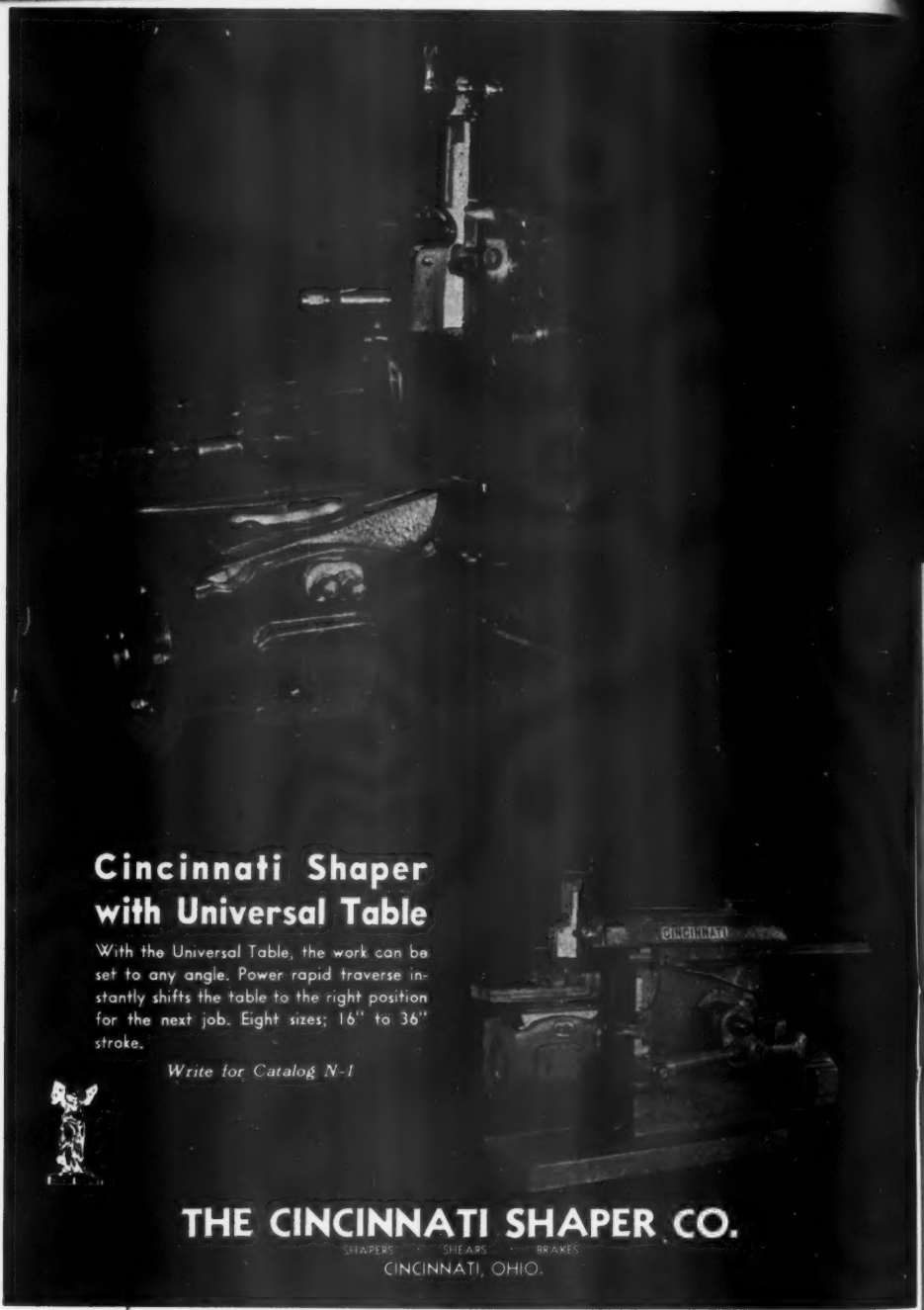
OF QUALITY CUTTING TOOLS

if it's an Arnold it's accurate

Many of America's leading manufacturers have learned that most of the quality cutting tools listed in the new Arnold catalog can reach them surprisingly fast. For instance, three types on which you can expect almost immediate delivery are illustrated above. They are: counterbores, straight and taper shank with interchangeable pilots and Woodruff key seat cutters. Arnold's thirty years of toolmaking experience can provide you with cutting tools that can be depended upon for maximum efficiency, service and accuracy. If you do not have our new 40 page catalog containing the complete Arnold line, send for it at once. No obligation.

Western Representative
JOHN HENLE
210 West 7th Street, Tel. Madison 4221
Los Angeles, California

ARNOLD
Tool Company
14469 EUCLID AVE.
EAST CLEVELAND 12, OHIO



Cincinnati Shaper with Universal Table

With the Universal Table, the work can be set to any angle. Power rapid traverse instantly shifts the table to the right position for the next job. Eight sizes; 16" to 36" stroke.

Write for Catalog N-1

THE CINCINNATI SHAPER CO.

SHAPERS · SHEARS · BRAKES

CINCINNATI, OHIO.

FONDA
PRECISION GAGE BLOCKS

IMMEDIATE DELIVERY

SIZE—FONDA GAGE BLOCKS are lapped and inspected under standard temperature (68° F) in a most modern plant.

PARALLELISM AND FLATNESS—FONDA GAGE BLOCKS are parallel and flat. The FONDA designed lapping equipment used in their manufacture does away entirely with the inaccuracies of lapping by hand.

SURFACE FINISH—FONDA GAGE BLOCKS have a truly remarkable surface finish which is unlike that of any other block. This superfinish means resistance to wear as the surface of the block is free of peaks that wear off in use.

STABILITY—FONDA GAGE BLOCKS are stable. Scrupulous care and much time are expended on the extensive processing to ensure stability.

FONDA GAGE BLOCKS are available in Inspection and Working grades at the prices shown. Immediate delivery can be given at present.

PRICES

Inspection Tolerance ± .000004"
82 Unit Set $350.00
35 Unit Set $190.00

Working Tolerance ± .000008"
82 Unit Set $295.00
35 Unit Set $150.00

METRIC SIZES ALSO AVAILABLE
PRICES ON REQUEST

TEN UNIT POCKET SET
Giving 327 Possible Dimensions Obtainable

Block Sizes

.03125	.250
.0625	.300
.100	.500
.125	1.
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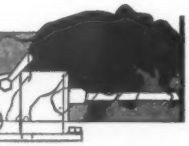

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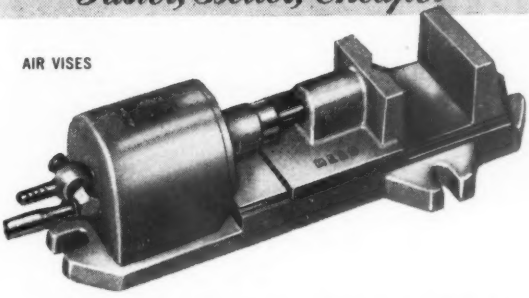

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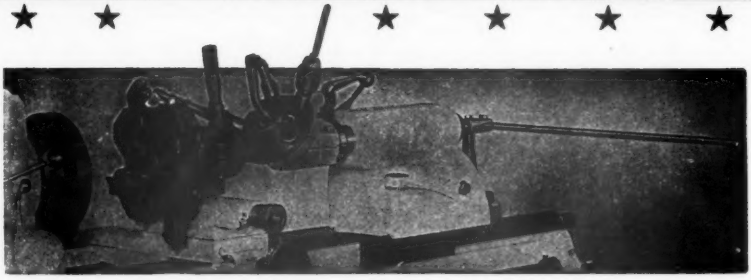

Photo above shows Jefferson Turrets on 16" lathe

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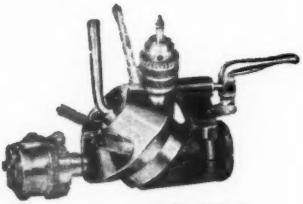

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Jefferson Bull Dog Precision Milling Machine
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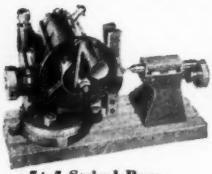
4-Tool Tool-Post Turret



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TURRET DELIVERIES IN 6 DAYS

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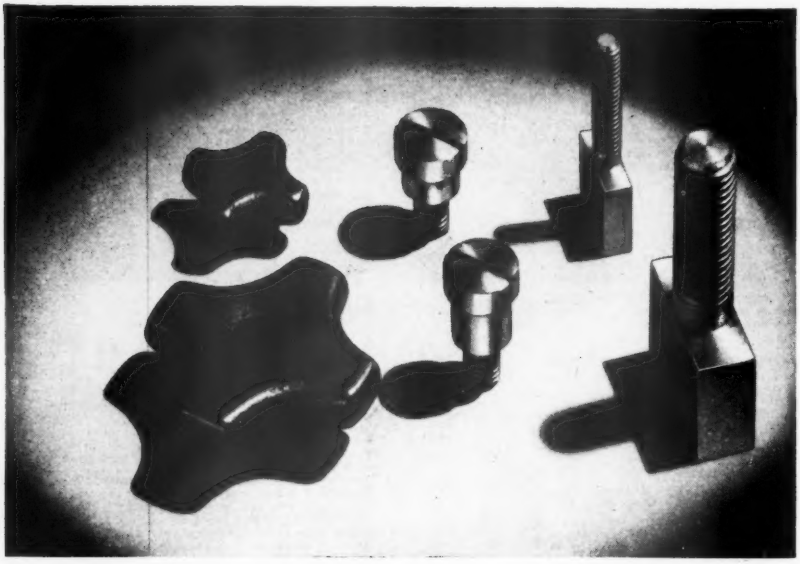

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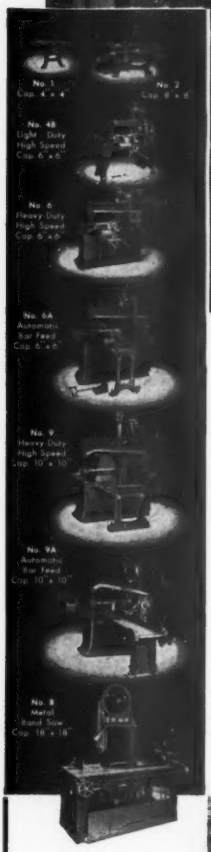

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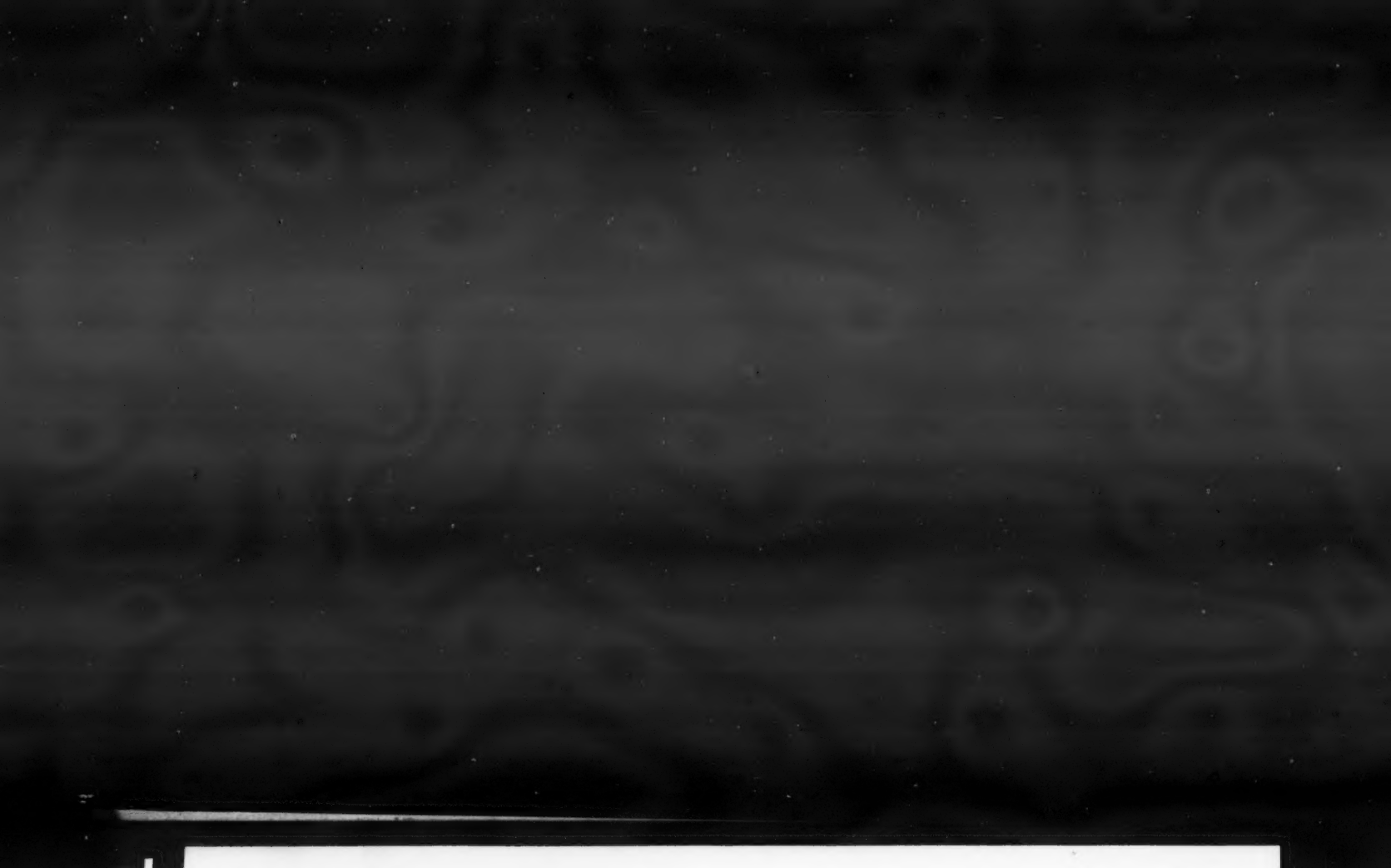
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